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THE INTERNATIONAL SUGAR·JOURNAL

A·TECHNICAL·&·COMMERCIAL
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TO·THE·SUGAR·INDUSTRY

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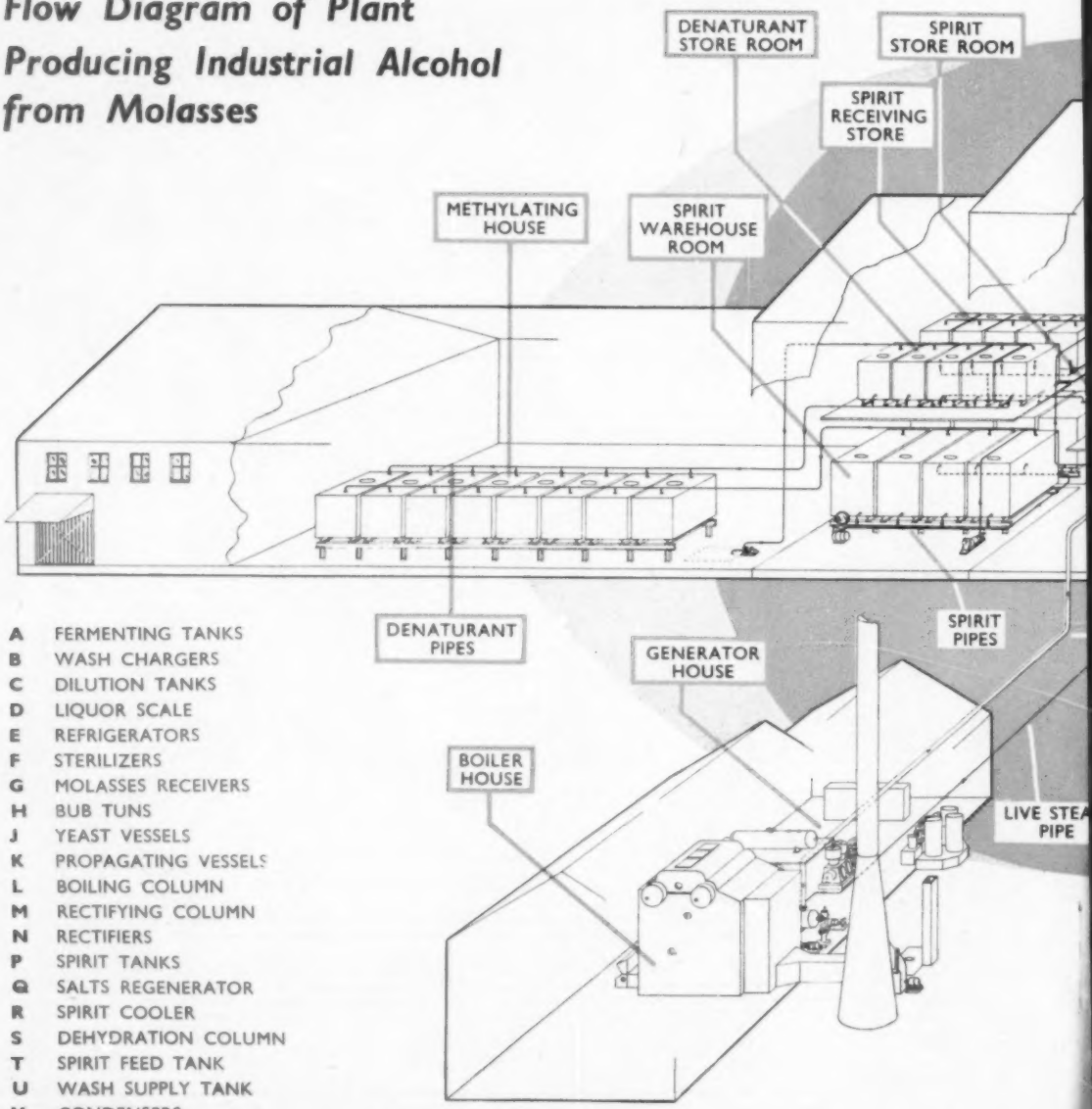
For LIST OF ADVERTISERS see page xlvi

BLAIRS

COMPLETE SUGAR

Flow Diagram of Plant Producing Industrial Alcohol from Molasses



- **A** FERMENTING TANKS
- **B** WASH CHARGERS
- **C** DILUTION TANKS
- **D** LIQUOR SCALE
- **E** REFRIGERATORS
- **F** STERILIZERS
- **G** MOLASSES RECEIVERS
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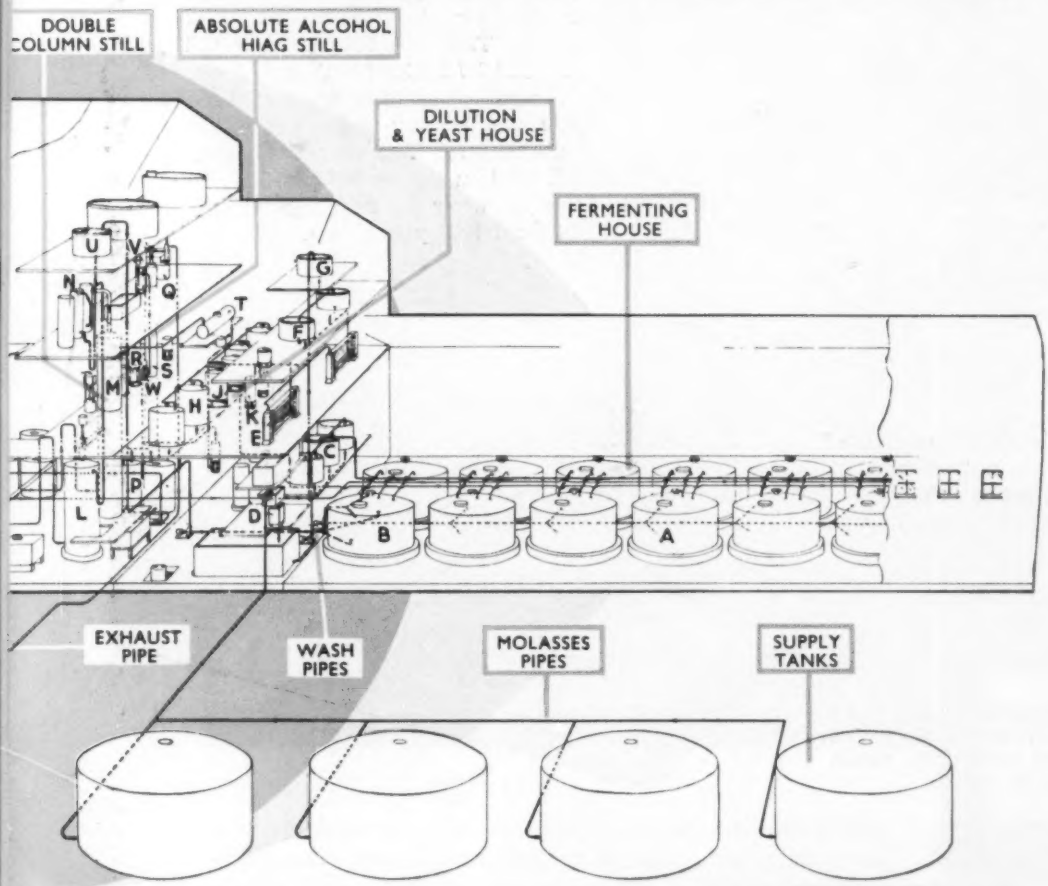

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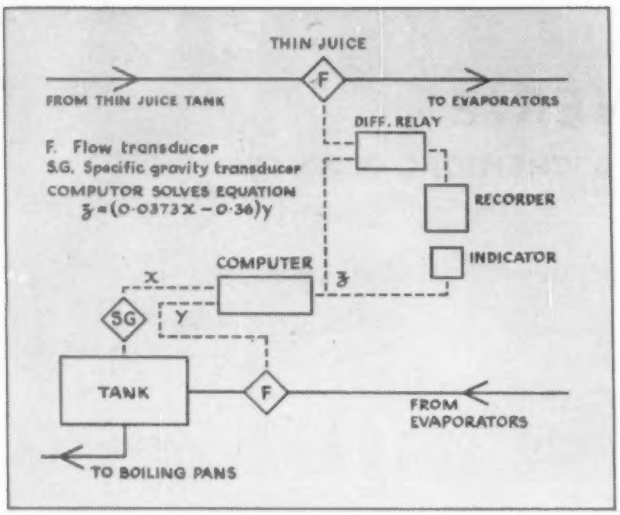
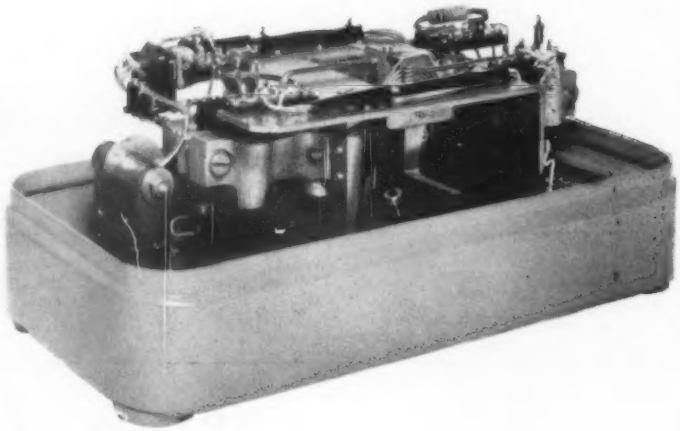
Simple check method on sugar losses in Evaporators gives greater plant efficiency



From input signals representing the thick juice flow rate and Brix degree THE EVERSHED SIMPLE ANALOGUE COMPUTER supplies a current corresponding to mass flow rate of raw sugar leaving the evaporators. The computer output indicated on the control panel is also used to supply the input signal to the differential relay as shown.

By the use of this simple method of calculation, sugar losses in the evaporators are kept under constant observation, thus leading to greater operating efficiency.



The Evershed Simple Computer is an analogue device operating on D.C. input signals (up to 6 inputs) and supplying an output current algebraically related to the signals.

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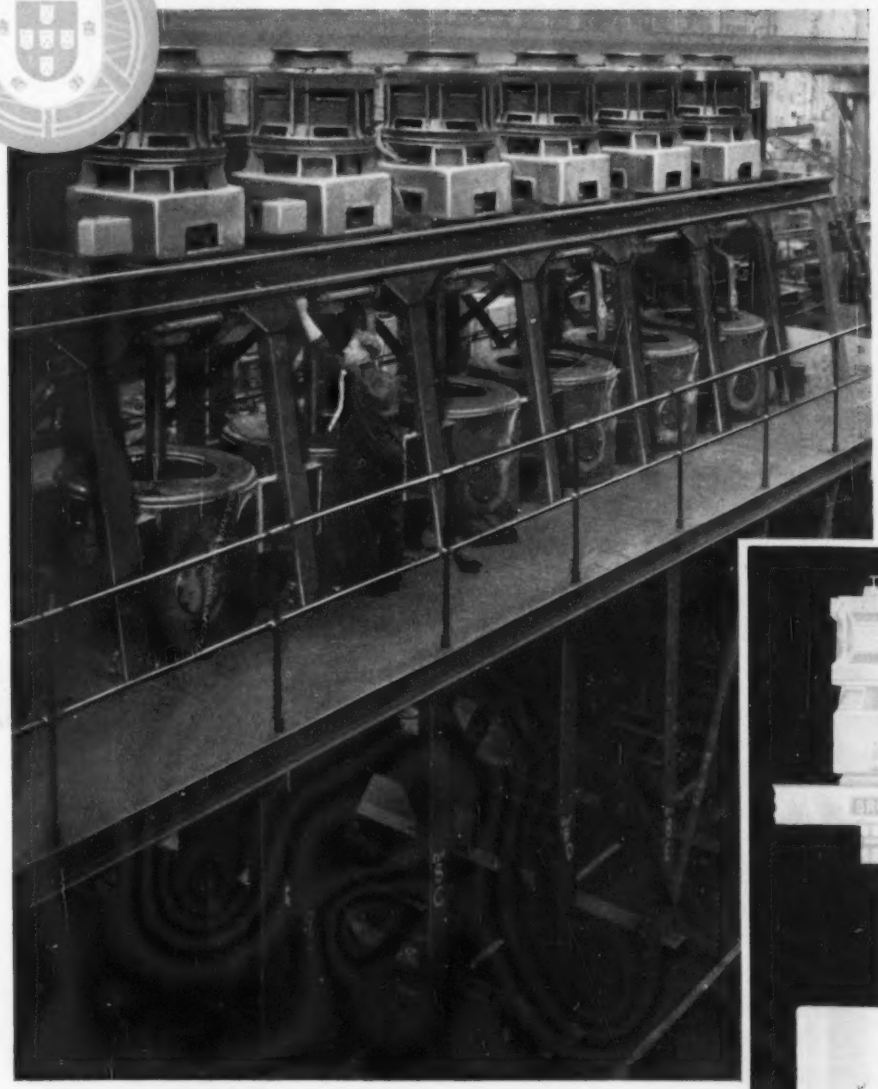

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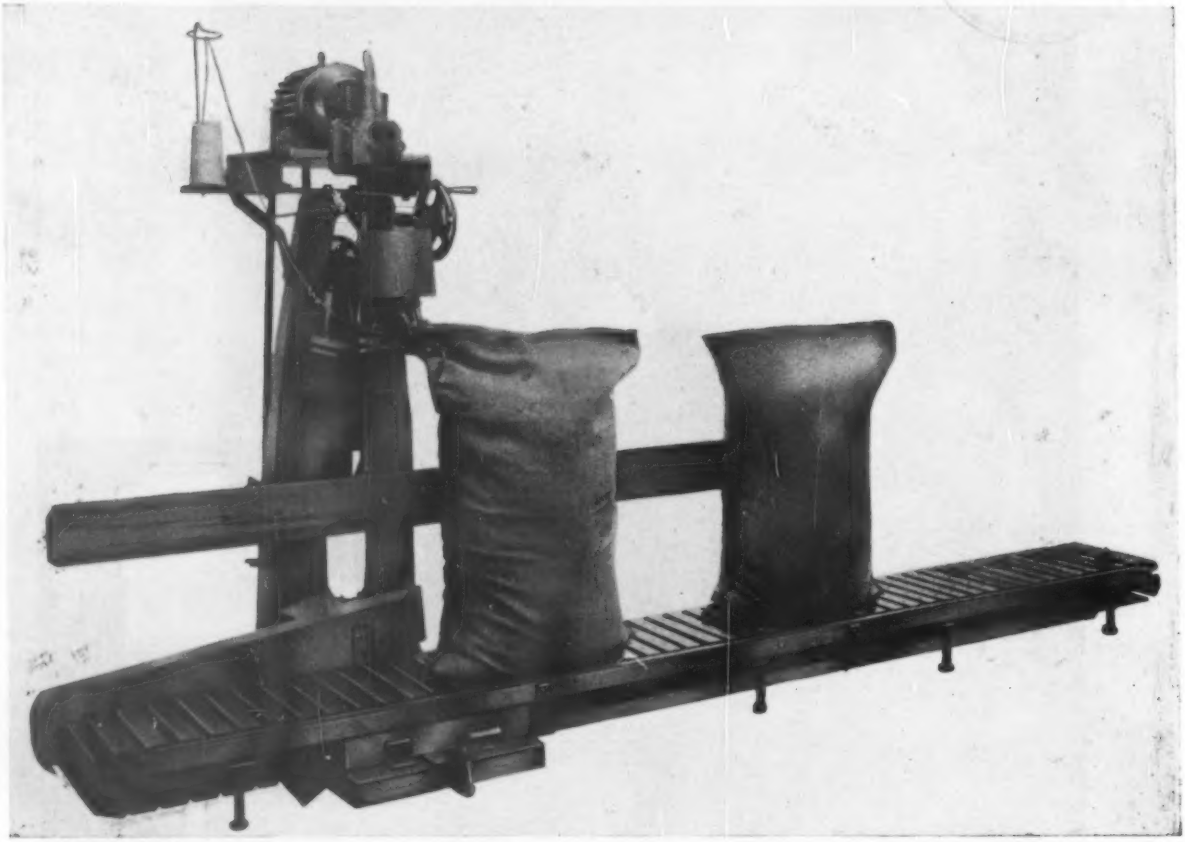

This machine is fitted with a conveyor 10 or 12 ft. overall and a Special Clutch Drive which allows the conveyor to be run independently of the sewing head.

Jute, Hessian, Paper Lined Hessian, Cotton and Paper Sacks weighing from 50 to 325 lbs. can be sewn on this machine.

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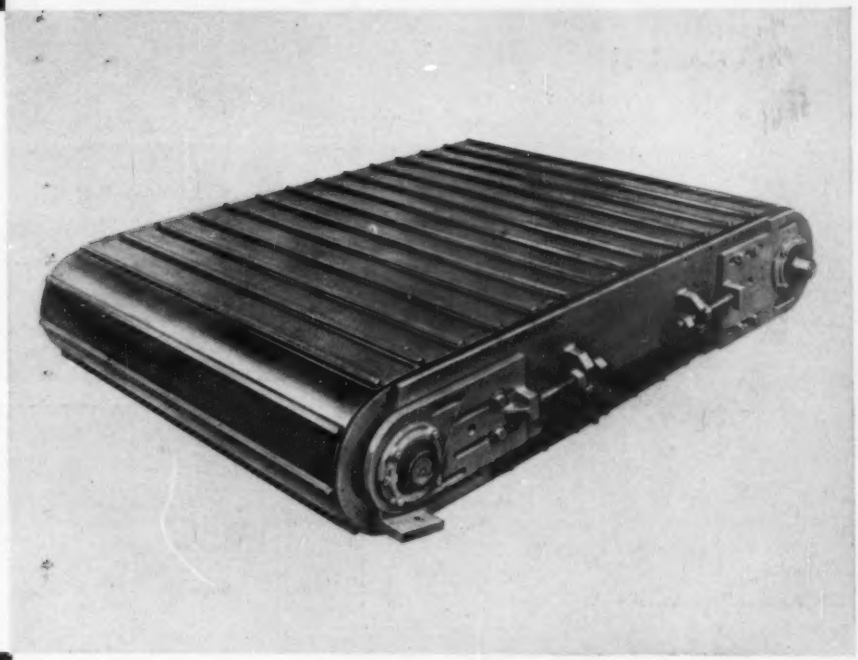
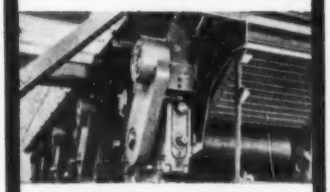
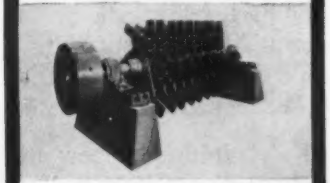


OTHER EQUIPMENT
reflecting Farrel leadership in sugar mill design



WICHITA AIR CLUTCHES
used in the carrier drive, contribute to ease and safety of operation; also used between gear units of a turbine drive.



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provide high efficiency with economy in the preparation of any kind of hard or soft cane.

More and more modern sugar factories the world over are standardizing on Farrel rubber-belt intermediate carriers. This has been proven by recent orders from such widely separated places as the West Indies and South Africa.

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Write for 40-page bulletin 312 which gives details of this new development, as well as the other equipment shown.

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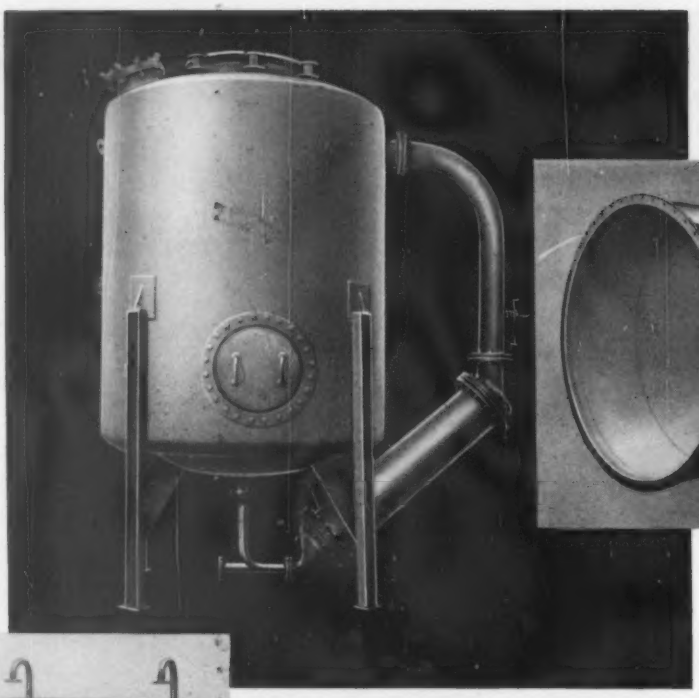
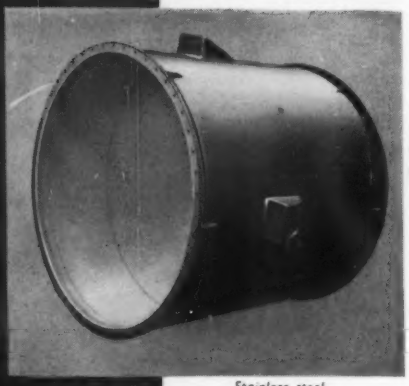
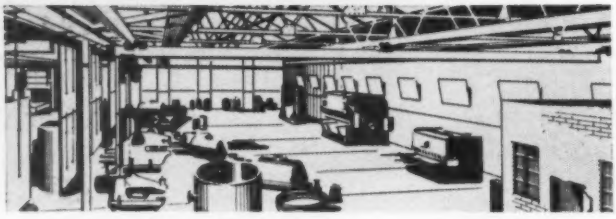


1,000 gall. kettle in ¼" copper. Lynx Quasi-arc welded.



Stainless steel vessel with mild steel jacket

12,000 gallon water separator



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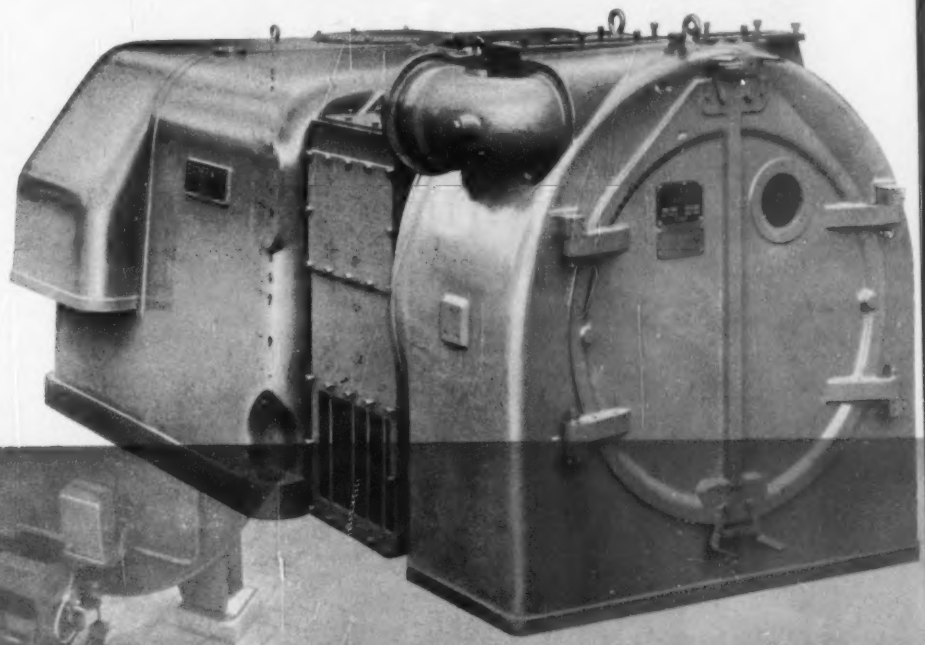
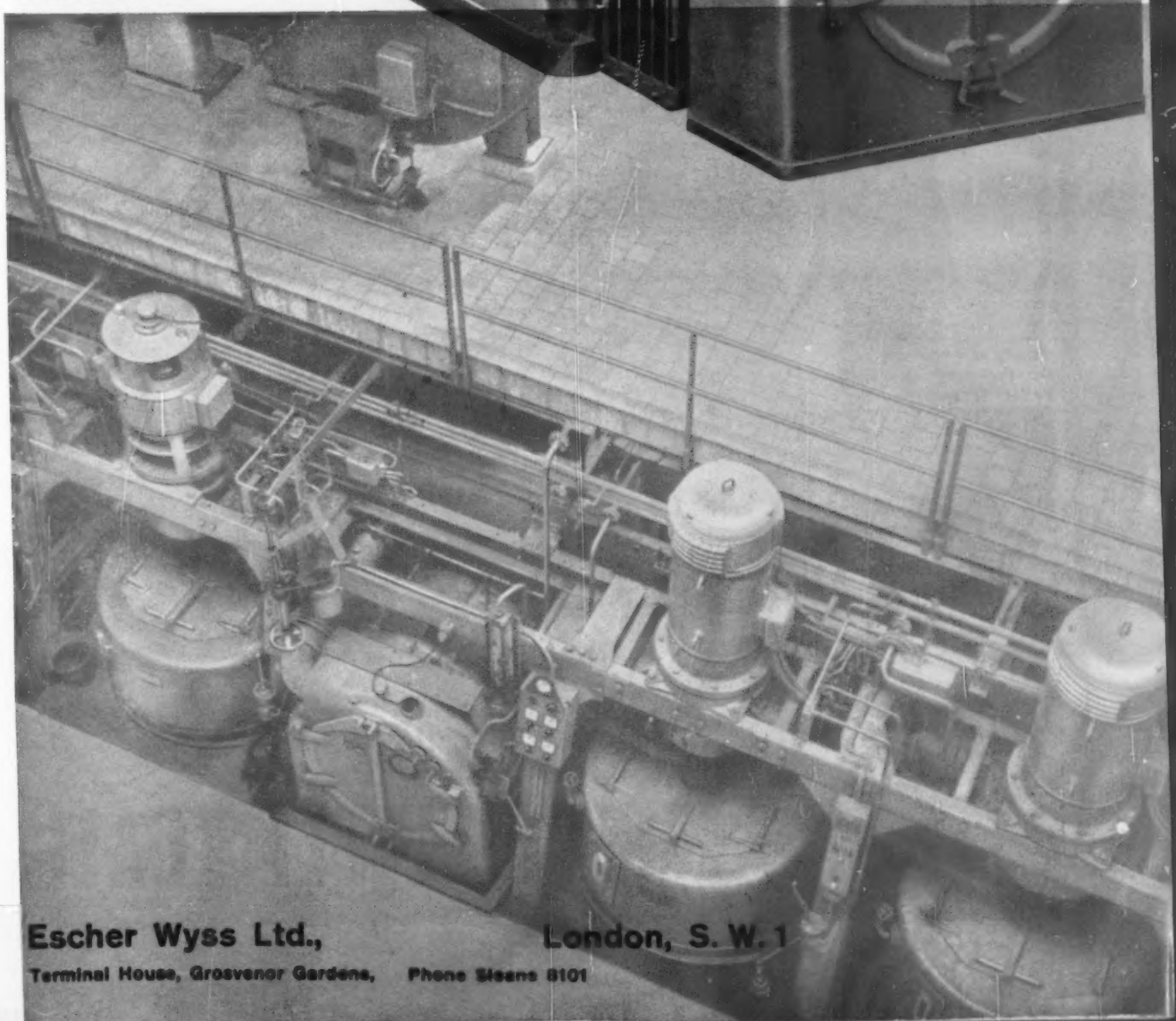


Escher Wyss Centrifuge as replacement in a battery of vertical machines.



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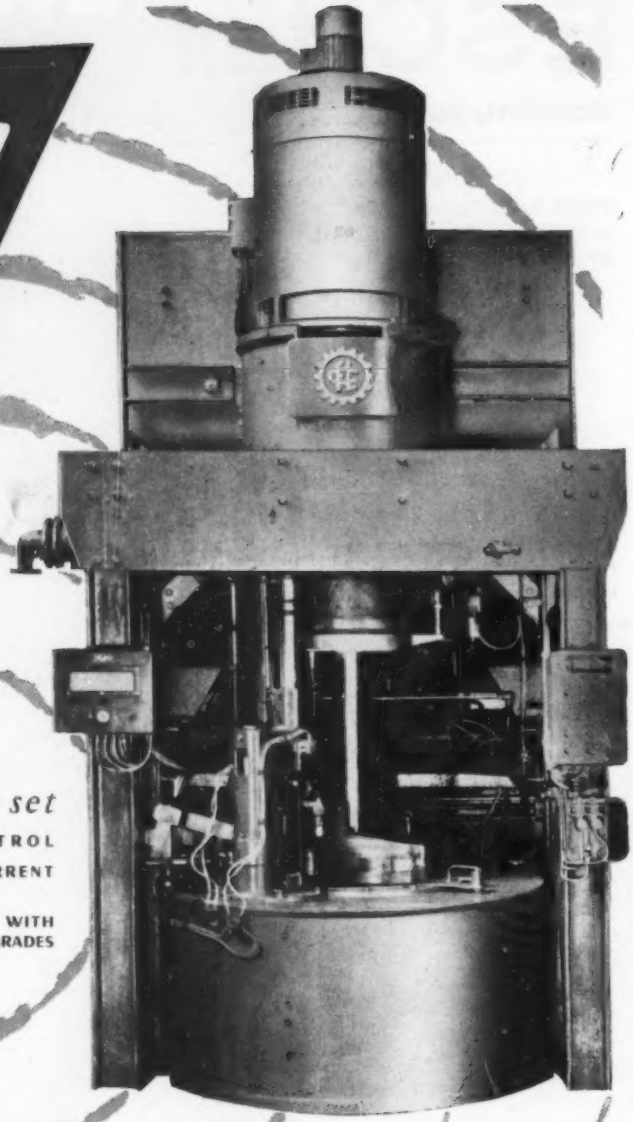

driven by
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- ELECTRONIC CONTROL
- ELIMINATION OF CURRENT PEAKS
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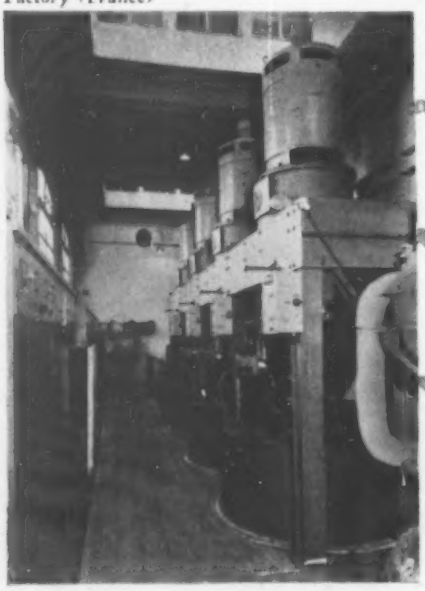
Battery of 4 centrifugals at the Fontaine-le-Dun Sugar Factory (France)



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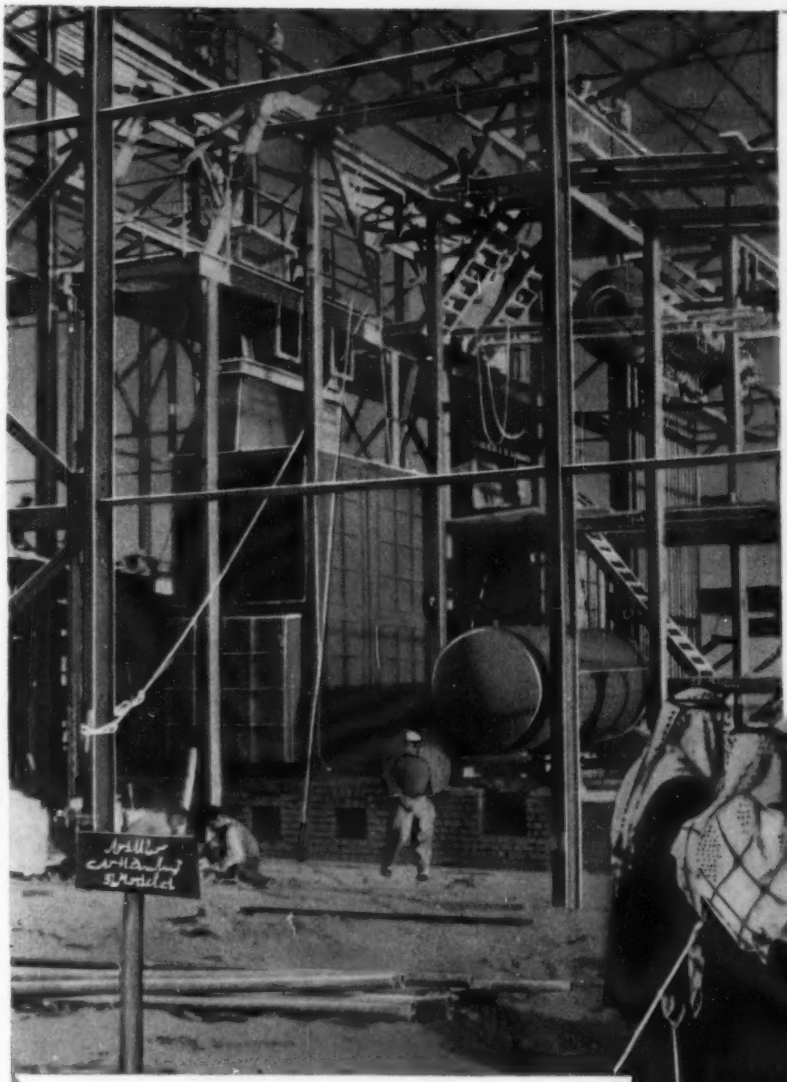

A little chat about factory routine among Arab foremen, whilst the erection of the Salzgitter sugar factory forges ahead on the sunny banks of the lazy River Tigris

SALZGITTER INDUSTRIEBAU GMBH

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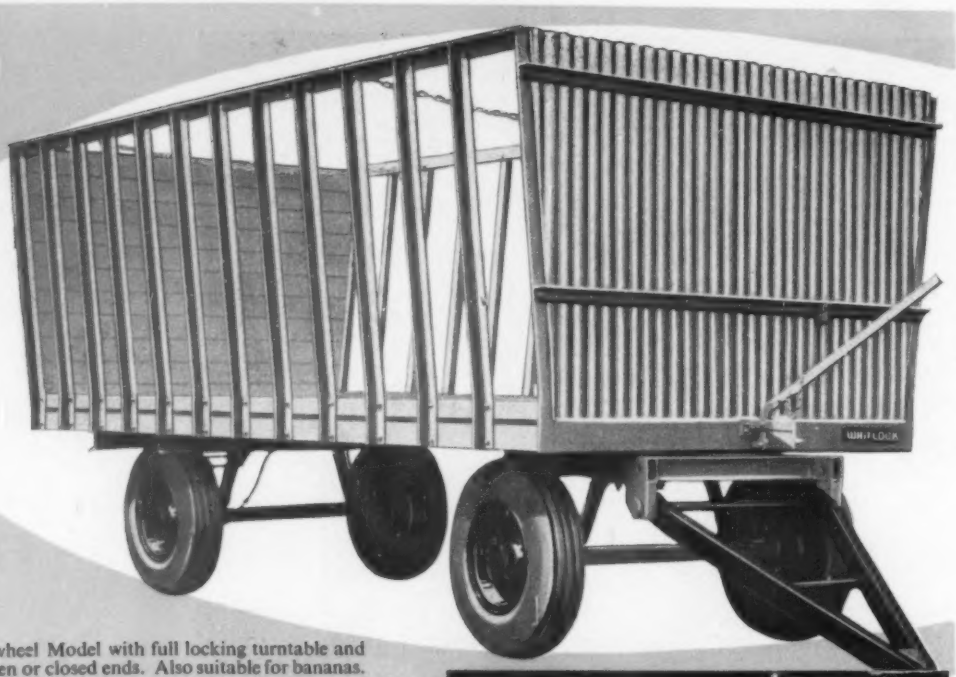
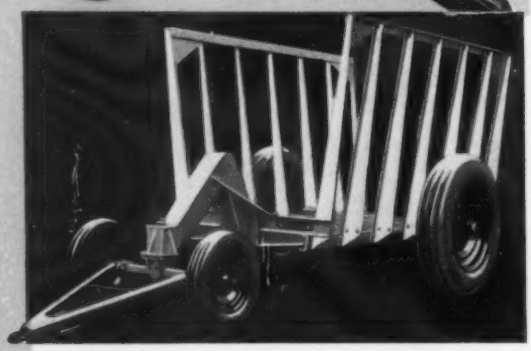
SALZGITTER-DRÜTTE **GERMANY**



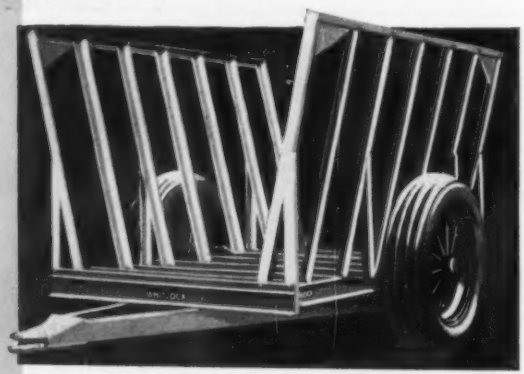
4-wheel Model with full locking turntable and open or closed ends. Also suitable for bananas. In various carrying capacities.

Cut cartage costs with

WHITLOCK CANE & FRUIT TRAILERS



4-wheel Goose-Neck type of pressed steel construction with extra heavy bracing for loads up to 6 tons.



A low cost model on large diameter wheels for loads up to 5 tons.

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an open letter to

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the world over

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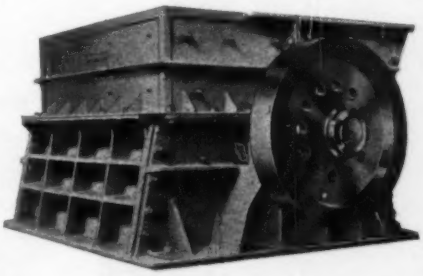

The Gruendler Cane Preparation Process has stepped up mill tonnages of cane per day by 15% to 25%, while delivering an evenly processed cane from which sucrose extraction has been increased from 3% to 4%. These percentages remain contant, no matter where the cane is grown. Using this increased tonnage, many mills have paid for the Gruendler Process in one crop.

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Sincerely,

W. W. Gruendler Pres.

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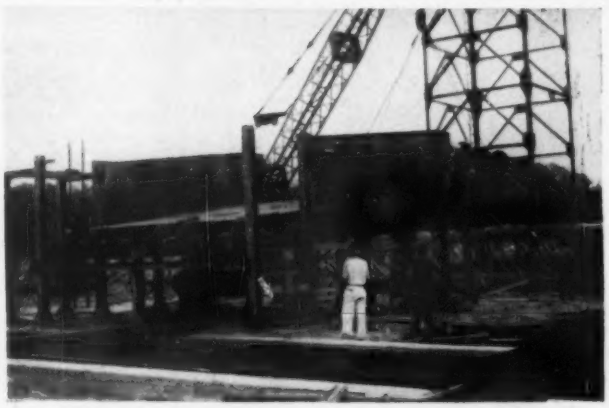
Even Feed...

. . . This first essential for good extraction is readily secured by the Mirrlees Feeding Table with levelling kickers.

The illustration shows an installation at a South American factory built and equipped by Mirrlees; the lower photograph was taken during construction. The Unloading Crane was also supplied by Mirrlees.



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in use in

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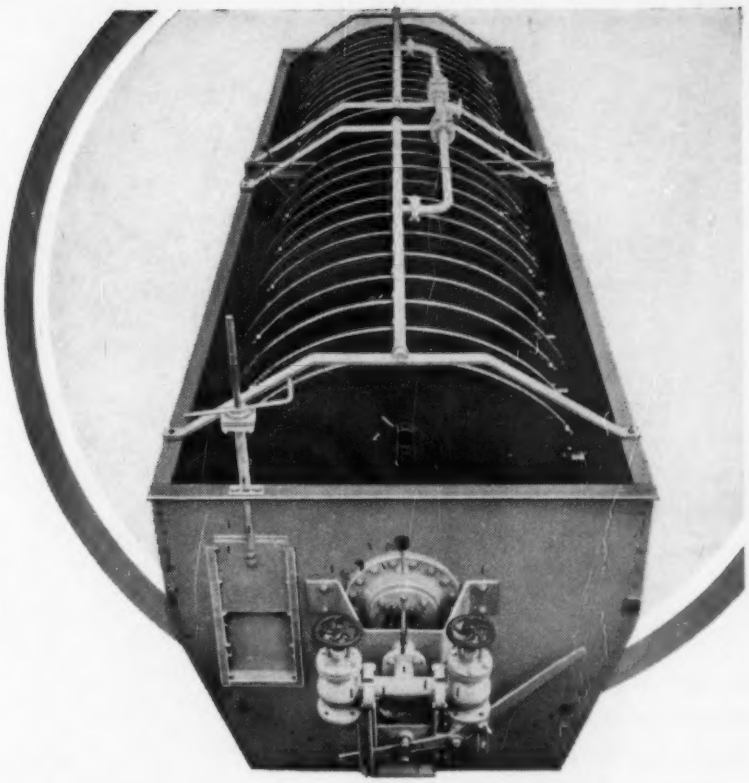

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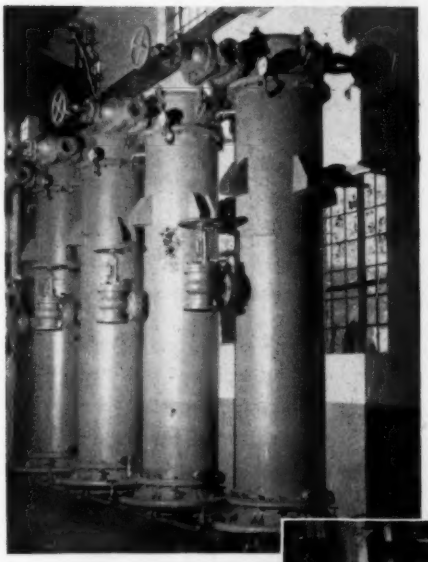

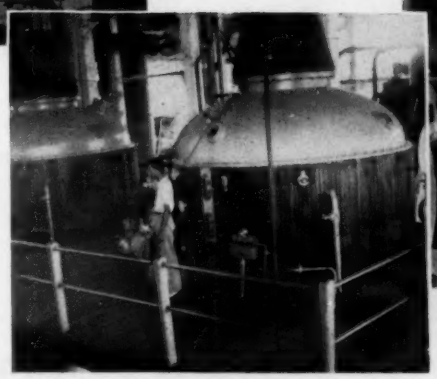

Above: Juice Heaters—Brazil; Right: Vacuum Pans—British Guiana; Extreme Right: Evaporators in one of the British Sugar Corporation Factories.

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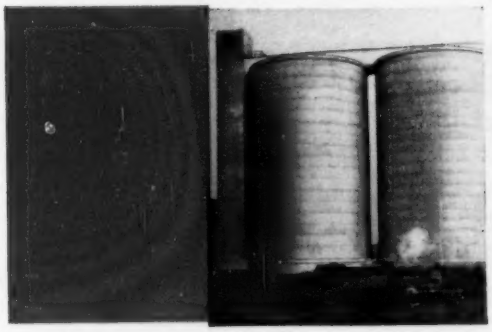

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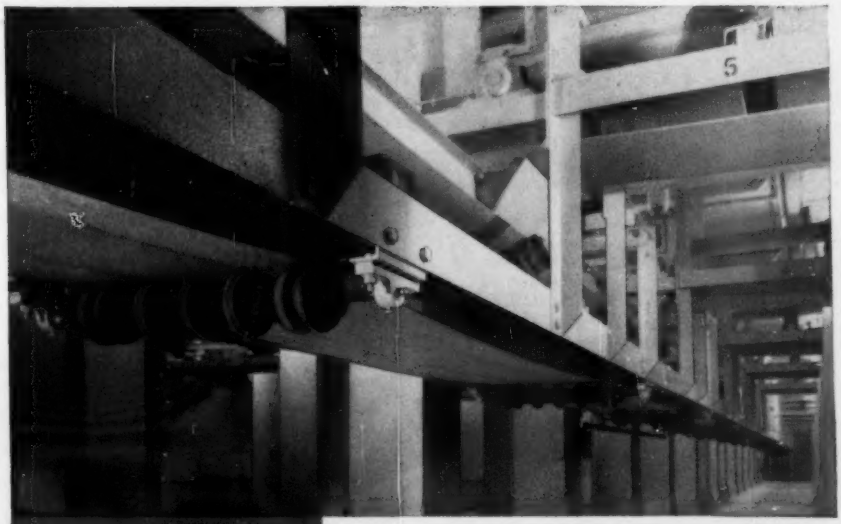

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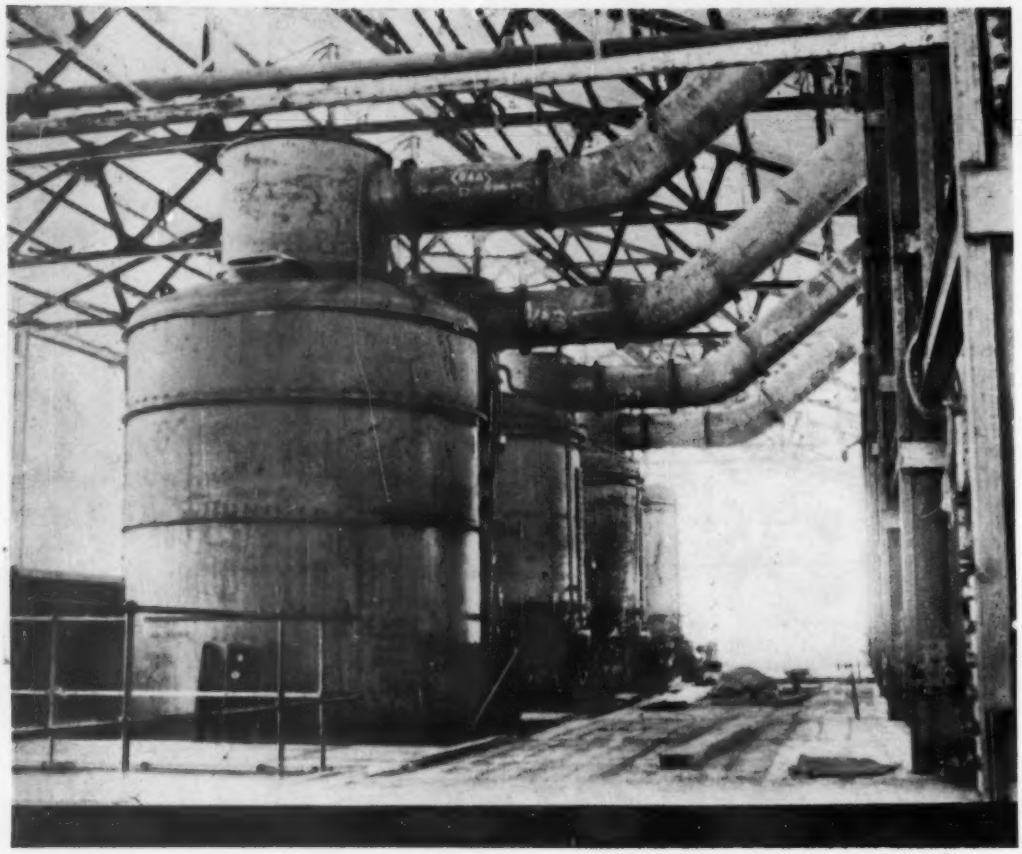

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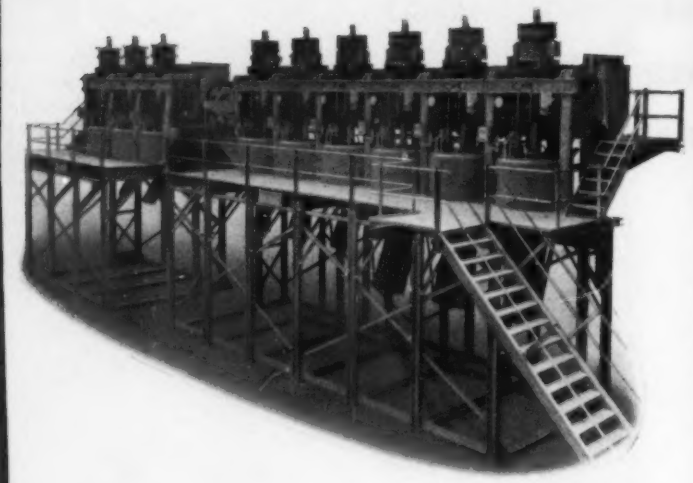

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THE
INTERNATIONAL SUGAR JOURNAL

VOL. LXI AUGUST, 1959 No. 728

NOTES AND COMMENTS

Mauritius Chamber of Agriculture Report, 1958/59.

Sugar production only reached 525,648 metric tons, which is about 10,000 tons less than the average for the last five years. The tonnage of canes crushed was slightly lower than in 1957 in spite of the large increase of more than 7000 arpents in the area harvested. The yield of cane per arpent of 24·5 tons was the lowest in five years, as was to be expected after the ill-treatment which the cyclonic winds of March and April 1958 had inflicted on the tall cane, especially in the more exposed regions of the Centre and of the West. This sharp reduction could not unfortunately be compensated by an increase in sugar recovery as conditions during the maturation period proved, on the whole, much less favourable than those of the last two years. Rain excesses from June to October, but more particularly in July, were sufficiently high to account in part for the fact that the sugar recovery % cane did not exceed 12·14; but this low average must be attributed mainly to the ill-effects of the cyclones, such as the lodging of the cane, without which a sugar recovery of 12·40% might reasonably have been expected. As a result of this substantial reduction both in cane yield and in sugar recovery, the tonnage of sugar per arpent was 0·34 ton lower than last year's figure of 3·31 tons. Field and factory results are tabulated below.

	1957	1958
Area under cultivation (Arp.)	182,665	189,217
Area harvested (Arpents)	169,578	176,678
Cane yield per arpent (metric tons)	25·6	24·5
Cane production (metric tons)	4,343,898	4,328,877
Sugar recovered % cane	12·94	12·14
Sugar production (metric tons)	562,003	525,648

After a rather slow start towards the end of last year owing to drought conditions which prevailed in certain regions, the coming 1959 crop made rapid and spectacular progress during the first four months of 1959 when weather conditions were, on the whole, satisfactory. It is not unreasonable to expect the same high average yield of cane per arpent as in 1956. The area to be harvested will again probably show a substantial increase over the previous year and is at present estimated at 182,000 arpents. On the basis of 26·3 tons per arpent, this should bring the cane tonnage to about 4,780,000 tons, which, with a normal sugar recovery of 12·12%, should make it possible to reach a final production figure of not less than 580,000 tons of sugar.

Bulk Handling.—It was previously announced[1] that an appropriate site had been reserved by the Government in the Quay D area for the eventual installation of bulk handling facilities for the storing and loading of raw sugars; and that the Chamber was taking steps to provide for the detailed planning of a scheme that would fit in the available space and that would not interfere either with the Customs Reception Area which was to be created on the adjacent site or with the use of Quay D itself for the handling of goods other than sugar.

Without committing itself or the Sugar Industry in any way the Chamber accepted towards the middle of last year an offer from Messrs. Tate & Lyle Ltd. to work out a scheme that would fulfil the above conditions. This necessitated a second visit to Mauritius of Mr. C. E. G. SIMMONS of Tate & Lyle Technical Services Ltd., to collect on the spot all the information necessary for the elaboration of the project. Mr. SIMMONS first visited Mauritius in January 1955 to advise the Bulk Handling Committee of the Chamber on the technical aspects of the problem they had been asked to study.

Before leaving, Mr. SIMMONS gave to the Bureau of the Chamber his preliminary views on the possible solutions to this particular problem of mechanization and recommended that an experiment be carried out before the end of the 1958 sugar campaign with the object of establishing a comparison between the behaviour of sugar stacked in bulk under varying conditions.

The following table offers striking evidence of the efficiency of the present "cutting and bleeding" or semi-bulk method as it is being used in Mauritius.

	1955 Crop	1956 Crop	1957 Crop	1958 Crop
Bulk Shipments (M.T.)	160,742	181,726	199,083	316,605
Total Exports (M.T.)	510,061	548,409	536,767	495,000
% of Total Exports ..	31·5	33·0	37·1	46·0

[1] *I.S.J.*, 1958, **60**, 201.

The figure may well reach 400,000 tons this year, representing about 70% of the estimated exports of the 1959 crop and covering most of the bulk requirements of the two preferential markets. In view of this, it is perhaps understandable that the Chamber should feel hesitant to advocate the adoption of an entirely new system. In any case, before recommending such a step the Chamber would have to be perfectly satisfied first that the proposed method for the mechanical storage and loading of our raw sugar in bulk would ensure the same adequate degree of protection against deterioration as the present one, and secondly, that its implementation under local conditions could be so planned as not to have any harmful repercussions on employment, as well as on the organization of dependent industries such as hemp-producing and sack-making.

Sugar By-Products.—The production of alcohol in 1958 was 1,643,072 litres, as compared with 1,559,152 litres in 1957, the volume of exports remaining negligible.

The sale of rum in Mauritius and its dependencies reached 1,582,668 litres in 1958, as against 1,466,688 litres in 1957 and 1,544,318 litres in 1956.

Approximately half the amount of molasses produced is, on an average, exported every year, the remaining half being used partly in the manufacture of alcohol and partly as a fertilizer on cane lands. The Sugar Industry Research Institute has appointed a technical committee to make a special study of the various industrial and other uses to which, under local conditions, the by-products of sugar might profitably be put.

Sugar Estate Modernization.—The amount spent on capital equipment for factories, rolling stock and agricultural implements continues to increase and reached the substantial figure of Rs. 46½ million in 1958, as compared with Rs. 31 million in 1957 and Rs. 25 million in 1956. The value of machinery on order is about Rs. 26 million, and the estates with factories have programmed for further capital expenditure of nearly Rs. 57 million.

* * *

N.V. Handelsvereeniging "Amsterdam" 1958 Report

Indonesia.—"The unlawful management of the Company's enterprises by the P.P.N.-Baru, referred to in our preceding Annual Report, was continued during the entire year under review. According to press reports this take-over of the management was followed by nationalization, retrospective to December 3rd, 1957, in pursuance of the "Act No. 86 relating to the Nationalization of Netherlands-owned enterprises in Indonesia", passed on December 27th 1958 and promulgated on December 31st 1958. This so-called nationalization of exclusively Dutch enterprises is—if only because of its discriminatory element—completely illegal and, as such, an offence against international law.

"With regard to compensations to be paid by Indonesia—which ought to be "prompt and adequate" —nothing is so far known. Act No. 86 is nothing but a "basic" law, which is still to be followed by regulations for its implementation. The Netherlands Government has once again protested to the Indonesian authorities against the above measures".

Ethiopia.—The output of the Company's Wonji sugar estate in 1957/58 was 32,504 tons, compared with 26,050 tons in the preceding season. Despite the higher output the comparable financial result of the financial year 1957/58 was practically equal to that of the preceding year because the considerable fall in world sugar prices affected the prices obtainable in Ethiopia. It is possible that the output of Wonji sugar factory will show a further increase, i.e. to about 34,000 tons in 1958/59.

Preparatory measures are continuing for the establishment of the second sugar estate. These measures relate to the preliminary treatment of the ground intended for the projected extension of sugar-cane plantings, the despatch of building materials to the factory site, the training of the personnel required for the second factory, etc.

* * *

Third Indian Five-Year Plan[1]

The Indian Central Sugar Cane Committee, at a two-day session held in New Delhi in March last, recommended a target of three million tons of factory white sugar and five million tons of gur and khandsari for the third five-year plan. It is understood that the Committee proposed that the area under sugar cane should remain at the present level of five million acres. The white sugar target is based on the assumption that the factories sanctioned during the first and second plans will be operating during the third plan.

To reach this target ninety million tons of sugar cane will be required for sugar, khandsari and gur whilst a further ten million tons will be needed for seed, chewing, etc. This compares with the second five-year plan target in 1960/61 of seventy-eight million tons.

If this production is to be achieved it will be necessary to raise the standard of field and factory efficiency and measures are to be taken with this end in view.

According to the *Hindustan Times* the Committee noted the fact that the current annual *per capita* consumption of white sugar was 11·4 lb and of gur 16 lb which is barely half what it should be, based on normal nutritional standards. Incidentally, no mention is made as to how the five million tons for gur and khandsari is to be divided.

At a meeting of the Development Council for Sugar Industry in February last the Chairman stated that owing to a deterioration in the country's foreign exchange position the Government had come to the conclusion that it could not grant licences for the import of sugar machinery for any more new factories against free resources or even against rupee payment. Further expansion of production capacity would therefore have to depend as far as possible on the manufacture of the necessary machinery in India.

[1] C. Czarnikow Ltd., *Sugar Review*, 1959, (406), 88.

SUGAR CANE IN THE BRITISH WEST INDIES

PROCEEDINGS OF THE MEETING, BRITISH WEST INDIES SUGAR TECHNOLOGISTS, NOVEMBER, 1957.

THE Meeting, held in Antigua, was opened by His Excellency, the Governor of the Leeward Islands, and was under the Chairmanship of J. McC. I. WATSON, Chairman of the Antigua Sugar Association. The Opening Address, delivered by G. T. WARREN, Chairman of the St. Kitts Sugar Association, drew attention to what he termed "Human Relations" raising two difficulties of growing importance facing, in particular, those smaller islands of which the economy is based almost entirely on sugar and bear no resources such as oil and bauxite capable of supporting industry ; they are : loss of skilled workers, in part due to the attraction of higher rates of pay but more so to the seasonal nature of employment in the sugar industry, and trade unionism. He described in some detail the somewhat intricate series of training courses now organized in the area to meet the first difficulty. His comment on the second is confined to pointing out how a co-operative spirit develops slowly and only when both sides are willing to learn, and it is, perhaps, unfortunate that recognition is not given to the fact that the soil in which that spirit develops most quickly is one of a co-partnership such as that on which the Gezira cotton scheme in the Sudan and the Fiji sugar industry are based and which is now on trial in British Guiana ; labour anchored to the land is resistant to subversive influences as paid labour is not. A Government-sponsored and supervised Peasant Development Organisation, such as that established in Antigua and described in the paper read by M. PARK and M. GEORGE, in which the history of this Organisation is described, likewise has little to commend it, since Government itself becomes an interested party and there remains no impartial arbiter.

CULTURAL PRACTICES

Three papers are concerned with the agricultural practices adopted in three territories. A general review of the investigations conducted in British Guiana was given by H. EVANS. The ground covered is necessarily very wide in view of the diversity of the ecological conditions and the paper is best considered as a valuable basis for further progress and record for reference. The same may be said of the paper by J. J. E. MESTIER and P. E. TURNER describing the system adopted in St. Kitts and of that by P. E. TURNER on estate practice in Antigua. In these, the ecological conditions are more uniform and are briefly noted. The losses of N from dressings of aqueous ammonia applied to different soils and by different methods form the subject of a paper by R. F. INNES, T. CHINLOY and H. M. THOMPSON.

In a paper by G. G. AUCHINLECK, the rainfall distribution of the West Indies is analysed. The central islands, those lying between Dominica and St. Vincent, have a single rainy season of 6 months; those lying within the influence of land masses, Cuba to Haiti and Grenada to Trinidad, are subject to monsoonal influences and have a double rainy season, the rainfall on intervening islands being transitional.

The effect of environmental conditions under which the crop is grown as affecting juice quality and behaviour in the factory also forms the subject of three papers. The influence of cane quality as affected by soil type and, in particular, drought, on clarification as measured by mud volume after standardized treatment of the juice, is discussed by J. R. MCFARLANE ; T. O. ELLIS, P. E. ROHIG and G. ARCENEAUX, of San Domingo, confirm results obtained in Louisiana and Cuba indicating the need for applying a varietal correction factor when determining the indicated yield of sugar as calculated from primary juice analyses and they also find large varietal differences in the furfural % dry matter in bagasse; R. A. YATES, discussing cane quality in British Guiana, indicates an adverse effect from rainfall, as also from increasing yields, with an economic yield under present conditions at 50 tons/acre (plant-plus-ratoons).

PESTS AND DISEASES

In 1954, nymphs of the froghopper, *Aenolamia varia saccharina*, showed signs of building up resistance to chlorinated hydrocarbons, particularly BHC, at Caroni, Trinidad, and "Malathion" has increasingly taken its place. A new organo-phosphorus insecticide, "Trithion", has now been tried on a small scale and the results reported by D. J. H. NEATE. In a comparative trial with "Malathion," with application towards the end of one brood, it has retained its effective control for 72 days (approx. 1% of the initial infestation)—a period covering the emergence of a third brood—while the peak of the second brood with "Malathion," reached in 40 days, approximated to 90%.

Leaf scald, wide-spread in the East and caused by the bacterium *Xanthomonas albilineans*, was first identified in the Caribbean area in British Guiana during 1950 and an account of its history in that territory where it has caused considerable losses, and of work accomplished in its study is given by J. A. PIRES. Many questions remain to be answered; meanwhile varietal resistance, derived mainly from *S. spontaneum*, supplies the chief means of control. The disease has since been reported from Martinique and St. Lucia and a general review of the position in the Caribbean area is given by J. A. SPENCE with evidence that the organism exists in different strains. Characteristics of the organism under culture are recorded by A. C. HAYWARD. The five bacterial

diseases, of which leaf scald is the most serious, are described by W. J. DOWSON. A paper by J. F. BATES on weed and pest control, except for a brief reference to biological control of *Diatrea*, is exclusively devoted to control by chemical agencies, and the same applies to the paper by J. R. STERRY on weed control on railway tracks.

GROWTH CONTROL

The effect of gibberellic acid as sprays, dips or spindle applications, from pre-treatment of setts to arrowing, as shown in preliminary trials in British Guiana, is described by J. F. BATES who, jointly with R. A. YATES, gives an account of 5 years' experiments on the effects on ripening of a number of growth regulators. H.M.-L.

THE SUGAR CANE IN HAWAII

REPORT OF THE EXPERIMENT STATION, HAWAIIAN SUGAR PLANTERS' ASSOCIATION, 1957-58.

FROM the record of work accomplished in this Report the staff of the Station appear to have been commendably successful in overcoming the difficulties arising out of the 4 months' strike early in 1958 which had so serious an effect on the Islands' sugar industry. The Report follows previous lines and much must be omitted in a brief review.

CULTURAL PRACTICES

The discussion under this head does not deal, as the title might suggest, with actual procedures of cultivation but with the objectives at which those procedures must aim if the maximum yield is to be obtained. This is largely a question of plant nutrition and involves all aspects of the crop log system. Confirmation was obtained of earlier results at Makiki indicating that time of application of N is of relatively small importance, even in encouraging ratoon growth. Of special interest, perhaps, are the experiments with tagged ^{15}N. The fact is revealed that total leaf punch N remains constant for all rates of N dressing but the atom % excess ^{15}N in the leaf is directly proportional to the amount of the dressing; in other words, with high dressings of N fertilizer, the plant uses less soil N. A further fact associated with increasing N fertilization is the maintenance of a constant total base in milli-equivalents, the K depression being made good by increases in Ca and Mg.

In the case of P, analyses of 8–10 internodes indicate responses as resulting, other factors not interfering, from a P level below 0·032%; between 0·032% and 0·040% they form an insurance. P deficiency expresses itself most clearly in suppressing stooling and it is the increased sucrose in these secondaries that adds so largely to the yield.

The increasing tendency to drop from the programme sulphate of ammonia and sulphur-containing phosphatic fertilizers has led to the inclusion in the lysimeter studies of the position of sulphur. Though the range of the S content of different soils is very wide—from 5 to 2,650 p.p.m.—so far no marked effect has been detected from this wide variation.

TILLAGE

Investigation into the use of a heavy moldboard plough ploughing to 24 in has followed two lines. There is the question of the friction due to adhesion. This varies greatly with the moisture content, rising steeply as this increases to some 22% and then falling. Adhesion is greatest with polished steel and the best reduction resulted from a cover of "Teflon" (P.T.F.E.) sheeting. The problems raised by the inversion of such a depth of soil, particularly that concerned with the burial of organic residues, are under preliminary study and are regarded lightly, perhaps too lightly. Soil compaction, which necessarily accompanies the new in-field truck harvesting of Lihue, is under observation.

MECHANIZATION

Mechanization in the field develops apace and the implements become even more complex, as is apparent in the machines now under trial for cutting seed cane. That which cuts, tops and sections erect cane provides seed of equal germinating capacity with hand-cut seed. Lodged cane offers a more difficult problem for which a cutting assembly has been designed. Further modifications have been made in the "liliko" (millable cane left in the field) pick-up earlier noted[1]. Other machines commented on are a cutter-transport, a two-way cut-load harvester and a light-weight flume pick-up for use in irrigated fields. Under design are spreaders for handling bulky organic manures, particularly trash, and under investigation is the possibility of producing a non-corrosive solution of mixed aqua ammonia and muriate of potash.

IRRIGATION

Much of this section is concerned with studies of the basic water requirements of the plant as disclosed by lysimeter readings and evapo-transpiration determinations. Field studies cover infiltration rates with the effect of a trash-bagasse blanket as an aid. Among the many innovations under trial is a rotary infiltrometer with a spread of 100 ft as alternative

[1] *I.S.J.*, 1958, **60**, 120.

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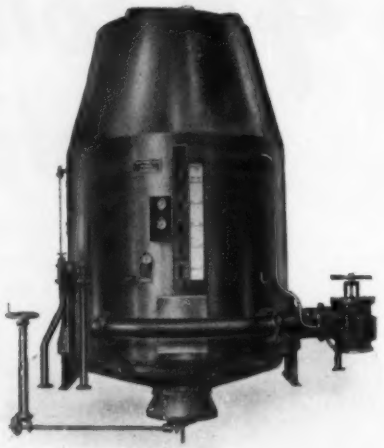

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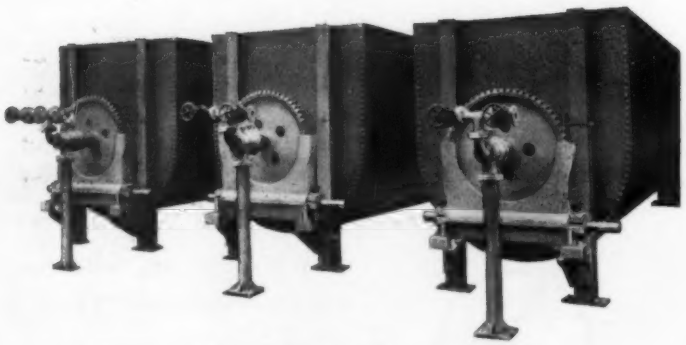

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to the normal sprinkler; the distributing pipes can be raised as the cane grows.

Varieties

Of over 4000 crosses, all but some 13% fell into "melting pot" series. There are many difficulties, both of area and labour, in selecting from the very large number of seedlings. Unfortunately, the correlation between Brix tally at 12 months and sugar yield at 24 months is too low for drastic elimination at the earlier age. By the adoption of "slash-cutting" in place of "cut and pull" harvesting,[2] the 30 × 30 plots are reduced from 900 to 800 sq. ft. and considerable saving in labour effected. Present difficulties, too, have led to a reduction of the variety testing programme on plantations. Ten varieties, in a N test, showed wide variations in their sensitivity to N as indicated by Brix and purity.

Control of arrowing is achieved by three methods; under normal conditions the withholding of water between 7th August and 15th September, securing youth in the cane by late planting or cutting back, and chemical treatment. The most effective chemical is CMU (85% in minimum amount of water) applied during the initiation period.

Diseases

An inspection of the Fiji trials of Hawaiian varieties in their resistance to Fiji disease and downy mildew is briefly noted. PMA as a seed treatment against pineapple disease has proved the most effective so far; "Bayer 22555", a systemic fungicide, proved highly effective in controlling *Pythium* root rot. The effect of fumigants on soil micro-organisms is dealt with in considerable detail particularly as influencing nitrification and the population of *Trichoderma*, parasitic on *Pythium* and other damping-off fungi. The possible part played by nematodes in the varietal decline problem has been further investigated.

Insects

There is no change in the general picture of the pest status. For convenience, rats are considered in this section and here "Endrin" appears to show promise.

Weed Control

A number of new herbicides are under trial and it seems possible that certain soil fumigants, such as methyl bromide may prove of value in controlling weeds.

Two papers which have recently appeared in the *Hawaiian Planters' Record*, may be conveniently noted here. The first[3], by J. W. Beardsley, describes the use of trap lights for the early detection of newly-established immigrant pests. The subject is of particular importance in Hawaii in view of its position on so many air routes. Though no serious pest has become established in the last 50 years, a list is given of 13 potential pests caught in light traps in the last 15 years. Ultra-violet "light" has been found more attractive than white light—the relative catch under the same conditions of time and area were 40,000 and 7,000 respectively. Location is determined at what are considered areas of maximum risk such as the neighbourhood of aerodromes.

The second paper[4], by C. E. Hartt, deals with the total P in the 8–10 internodes as a guide to fertilization. It gives in considerable detail the basis of the conclusions summarized above.

H.M.-L.

AGRICULTURAL ABSTRACTS

Yield Responses to Different N-P-K Levels, and Correlations with Foliar Analysis, in Sand-Culture Studies with Corn, Sugar Cane and Cotton. J. A. Bonnet *et al. J. Agric.* (Univ. Puerto Rico), 1958, **42**, 168–184.—Table 10 gives the P and K content of the leaf at ages 2–7 months when grown in sand culture with P 1, 5 and 9 units (K 13 units) and K 1, 5, 9 and 13 units (P 9 units), a unit being 0·015 lb P or K to 1540 lb sand. Table 11 gives corresponding data for 1·0 to 10·0 units N, a unit in this case being 0·13 lb N.

* * *

Application of Hand Refractometer in Sugar Industry. IV. Western Region in Uttar Pradesh. S. C. Sen and D. R. Handa. *Indian Sugar*, 1958, **8**, 51–63.—The use of the hand refractometer in cane sampling is further discussed. As the ready reckoners previously worked out for Rohilkhand region[5] are not applicable to Uttar Pradesh, an equation has been developed for the calculation of stalk Brix from the middle internodal Brix of the standing cane. Regression equations are given for the November/December, January, and February/March periods for estimation of pol % juice, sugar % cane, and recovery % cane. Good correlation has been found between estimates of the above factors and the observed values. Ready reckoners have been worked out for recovery % cane for the 3 periods given above.

* * *

Crosses of Sugar Cane at the Agronomic Investigations Centre. D. A. Ortega and G. A. Torrellas. *Agron. Trop., Venezuela* 1957, **7**, 69–81; through *Plant Breeding Abstracts*, 1959, **29**, 531.—After an account of the breeding aims, the chief parental varieties used and the crossing procedure and testing methods employed at the above station at Maracay, Venezuela, a list of selections undergoing trial is presented, together with details of their parentage.

[2] *I.S.J.*, 1956, **58**, 268.
[3] *I.S.J.*, 1958, **55**, 237–242.
[4] *I.S.J.*, 1958, **55**, 243–270.
[5] *I.S.J.*, 1958, **60**, 350.

Performance Tests of some selected Hybrid Sugarcanes at La Granja Experiment Station. T. J. TAPAY. *Philippines Sugar Inst. Quart.*, 1958, **6,** 15–30; through *Plant Breeding Abstacts*, 1959, **29,** 532.—All the eight hybrid selections tested at the above station in the Philippines were more resistant to Fiji disease than the standard variety Alunan, Phil 48–21 (Barbados 10/12 × POJ 2883) and Phil 48–15 as both plant and ratoon canes. Phil 49–22 and Phil 49–4, both from Trojan × Alunan, exhibited the fastest growth and gave the highest yields of sugar.

* * *

On the Phenolic Content of Sugarcane and Spontaneum Juices. K. PARTHASARATHI and M. VIJAYASARADHY. *Curr. Sci.*, 1958, **27,** 218–19; through *Plant Breeding Abstracts*, 1959, **29,** 534.—Six Co canes and six varieties of *Saccharum spontaneum* were analysed for content of phenols expressed as phloroglucinol. Of the former canes, Co 285 had the highest content (102 mg per 100 g of juice). The value for the remaining Co canes ranged from 58 to 28 mg. The phenols content of the *S. spontaneum* canes varied from 139 to 70 mg, with the exception of SES 532 which contained only 45 mg. It is suggested that high content of phenols may be of significance in determining hardiness and disease resistance.

* * *

Factors Affecting the Flowering of Sugarcane. R. E. COLEMAN. *Plant Physiol. Suppl.*, 1958, **33,** 20 (*Abst.*); through *Plant Breeding Abstracts*, 1959, **29,** 535.—The effects of various treatments upon flowering in canes normally remaining vegetative were investigated at Houma, La., as a preliminary to controlled breeding. Flowering was induced in two varieties by a photoperiod of 12 hr and 25 min. When one variety was subjected to noninductive day-lengths from 15th July to 1st September, it flowered as the result of treatment with inductive day-lengths after 1st September. Foliar sprays with growth regulators, antiauxins and organic acids or shade treatment during the latter part of the day failed to bring about flowering.

* * *

Labour requirements for Sugar Beet. J. S. NIX. *Agriculture*, 1959, **65,** (11), 549–553.—Figures are given, in man hours per acre, of the amount of labour used in producing sugar beet in Britain during the last 30 years. The figure for 1927 was about 235 hours : that for 1954 was 156 hours and that for 1957 only 115 hours, thanks to the widespread adoption of mechanized harvesting which is now used for 55% of the country's total crop. The other major labour requirement, spring hoeing, remains as yet largely unmechanized. Mechanical harvesting and thinning can be worth while on as little as 8–10 acres.

Manuring Sugar Cane by Irrigation and Aerial Distribution. A. C. BARNES. *S. African Sugar J.*, 1958, **42,** 1029–1035.—A survey is given of the present-day methods employed, with reference to their relative efficiencies under different conditions.

* * *

New type of Sub-Soil Drainage Pipe. ANON. *S. African Sugar J.*, 1958, **42,** 1073.—Made of spun reinforced concrete and slotted, the pipe permits the passage of tractors and other mechanized equipment over a sub-soil drainage system without fear of breakage.

* * *

Cultivation Practices on Thailand Sugar Plantations. J. C. P. CHEN. *Sugar J.* (La.), 1958, **21,** (1), 14–17.—In this review, necessarily cursory, cultivation is given its widest interpretation to cover varieties.

* * *

Controlling Ratoon Stunting Disease. R. J. STEIB, I. L. FORBES and S. J. P. CHILTON. *Sugar J.* (La.), 1958, **21,** (1), 22, 23, 26 and 28.—Experience with treatment in an electric hot-air oven is recorded. 8 hr exposure to a temperature of 50°C may be considered normal for most varieties but there are slightly different critical points of temperature for different varieties. There may be, also, different strains of the virus which are inactivated at different temperatures. Johnson grass is found to be a carrier, though symptomless, and its eradication from the cane fields is all the more essential.

* * *

Soil Conservation. J. W. BEST. *Sugar J.* (La.), 1958, **22,** (6), 8–13.—The article describes the organization of a State Soil Conservation Committee with District supervisors providing a free service, and the nature of the work under taken by these.

* * *

Cane Payments Methods. ANON. *Australian Sugar J.*, 1959, **51,** 801–805.—The problem of evolving a method for determining quality in cane such as would afford a really satisfactory basis for payment still remains unsolved. In Australia a considerable amount of investigation has been conducted which is reviewed here together with the announcement of a Committee of enquiry into the technical aspects involved.

* * *

Nitrogen Content and Yield of some Sugarcane Varieties. A. SINGH and B. SINGH. *Curr. Sci.* (Indian Inst. Sugarcane Res., Lucknow), 1958, **27,** 393–394; through *Soils and Fertilizers*, 1959, **22,** 425.—Field trials showed an inverse relationship between the N content and yield of five cane varieties, such as, e.g., 0·34% plant N and 752·4 maunds/acre average yield in Co 453, and 0·45% N and 379·4 maunds yield in Co 313.

THE DETERMINATION OF SUGAR IN SUGAR BEETS

Part V. Automation in Tare Laboratory Procedure

By Wm. H. PARKER, M.B.E., M.Sc. (Chief Chemist, British Sugar Corporation Ltd.)

THE commercial determination of sugar in sugar beets involves dealing with a very large number of samples in a short time—in sugar beet factories during a campaign (including the field sampling period), by breeders of sugar beet seeds, and also by other interested parties who stage field trials such as fertilizer manufacturers, etc. Simplification of the analytical procedure and the advantage of applying automatic techniques, where possible, will be obvious. The purpose of this article is to give a brief description of the progress made in this direction by the Chemical Control Service department of the British Sugar Corporation, with a view to eliminating the human element and thereby ensuring greater efficiency. It is not intended to include an account of the mechanical transference of samples between or during the various stages of the analysis as this is now common practice in tare laboratories in many beet growing countries of the world.

Sugar-contents can be determined either by calculation from the analysis of the expressed juice from the prepared pulp sample, by extraction, using a suitable solvent, or by digestion, using a known volume of added water and clarifying reagent either hot or cold. This last method was the first attempt at simplifying the analytical procedure and was made by KAISER and LÖWENBERG in about 1892. It was subsequently modified by SACHS & LE DOCHTE and their cold water digestion is now one most widely used in beet sugar factories for the mass determination of sugar contents where samples taken from individual deliveries of beets are analysed. It was described fully in this Journal in 1927 to which reference may be made[1], although the actual calculated volume of added liquid now used has been varied in some cases from the 177 ml used in the original method because of the variations found in 'juice volume' (see Part IV of this series of articles[2]).

Assuming that the sample of brei has been properly prepared the main stages in the analysis procedure are:

1. Weighing out the normal weight (26 grams) of brei ;
2. addition of the agreed volume of basic lead acetate solution (177 ml or so) ;
3. covering the capsule with the standard rubber covered disc so as to seal the contents ;
4. shaking for 10 seconds vigorously and leaving to digest for 10 minutes ;
5. re-shaking, uncovering the capsule and filtering off the clear extract into a glass beaker ;
6. pouring the extract into an observation tube and reading off the sugar percentage in degrees I.S.S. in a saccharimeter calibrated for a normal weight ; and
7. recording the result on the tare and test ticket for each sample under test.

These various steps have been modified by us over the years with a view to simplification and where possible automation has been introduced to eliminate the human element and thus to reduce errors.

(1) *Weighing the normal weight of brei.*—This was done originally in tared metal capsules of special design each of which had to be checked for tare quite frequently. It was a tedious operation and was very soon superseded by weighing the brei on an "Onion Skin paper" cut exactly 4 in square. This paper has a glazed surface on both sides and is specially rolled so as to be of uniform thickness and so to ensure that there is no significant difference in the weight of individual squares. One square is used as a counterpoise on the balance from each new packet of papers

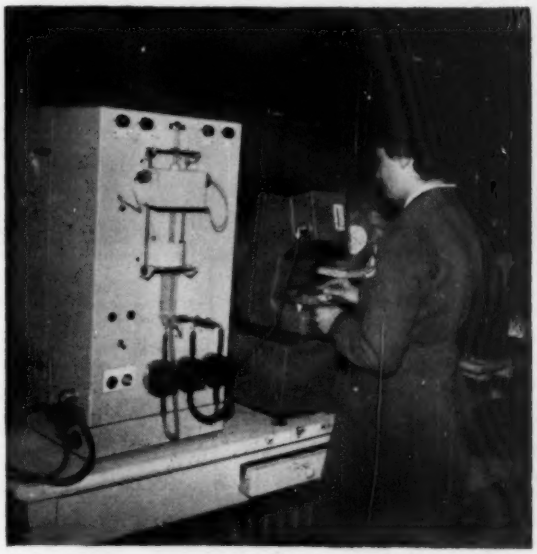


Fig. 1

put into use. The advantages are that the brei is more exposed to view by the balance operator so that any stray bits of foreign matter or course chippings which may have escaped the notice of the mixer, who prepares the brei, can be removed. It is also easier to adjust each sample to exactly 26 grams than by "fishing" for tiny pieces in the bottom of the fairly deep capsule, and there is no need to adjust the weight of the capsules which must be done very frequently in order to keep them to an exact tare.

[1] *I.S.J.*, 1927, **29**, 216.
[2] *I.S.J.*, 1958, **60**, 197.

Fig. 2

(2) *Adding the Basic Lead Acetate (B.L.A.) clarifying solution.*—The standard procedure was to deliver a fixed volume (177 ml or so) from an automatic pipette of special design which had to be filled and emptied manually for every sample.

We now have a shadow 'difference' weigher which has been adapted to operate electronically an automatic reagent adder which makes it unnecessary to weigh out exactly 26 grams.

This apparatus, depicted in Fig. 1 above, adjusts automatically, by means of a photo-electric level controller the exact quantities of B.L.A. clarifying reagent in the pipette corresponding to the weight of brei placed in the scale pan so long as this is within ± 1 gram of the normal weight. The brei is then transferred on the onion skin paper on which it has been 'weighed' to the capsule and the B.L.A. is then discharged from the pipette by push-button control.

(3) *Covering the capsule* still has to be done by hand.

(4) *Shaking for* 10 *seconds* and setting aside for ten minutes extraction time. To ensure adequate movement during digestion, the Murray brei shaker was designed and is depicted above in Fig. 2.

It holds just a sufficient number of capsules so that when full the first has been agitated for the required ten minutes and is ready to be removed and the contents filtered off. In this way extraction is complete without the use of special blenders and is a much more silent procedure.

Figs. 3a and 3b give constructional details.

(5) *Re-shaking and filtering* is still a manual operation.

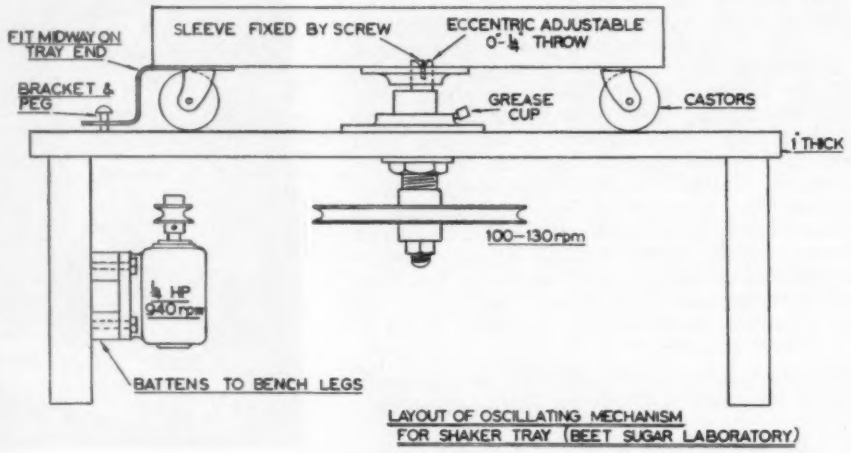
(6) *Reading off the Sugar content.*—The filtrate from step (5) is poured into the funnel of a 400 mm continuous flow ('Pellet') tube situated in the trough of a saccharimeter of normal weight and the sugar content read off by eye on a scale after adjusting the 'field' to balancing point.

(7) *Recording the result* on the tare and test ticket for each sample was done by hand.

Operations (6) and (7) are now done entirely automatically in the E.T.L.–N.P.L. Automatic Polarimeter type 143A which is described below.

The search for such an apparatus has been going on for a long time and the instrument we now have eliminates three main sources of error, namely, personal errors, incorrect recording of a result and errors due to tiredness of operators, particularly through eye strain.

Perhaps the first attempt at automation was the printing attachment fitted to an ordinary saccharimeter produced by KOONTZ of the Great Western Sugar Co. of America. This consisted of a large disc acting as a die-printer, the figures for sugar percentages



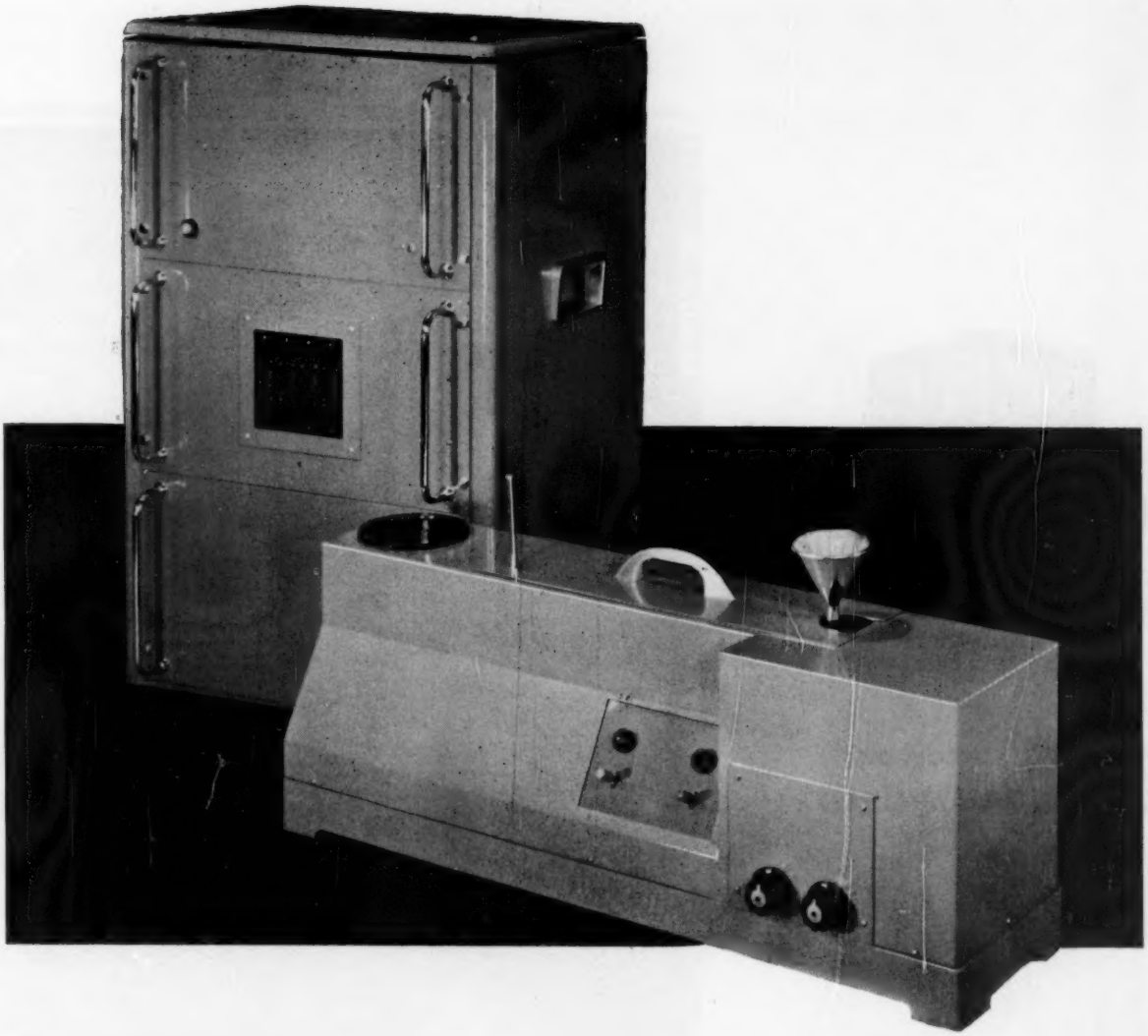
LAYOUT OF OSCILLATING MECHANISM FOR SHAKER TRAY (BEET SUGAR LABORATORY)

MURRAY TAREHOUSE BREI SHAKER

Fig. 3a.

corresponding to the reading on the Vernier scale being positioned round the periphery of the disc. Readings were printed by inserting the tare test card between the disc and an electrically energising striker, the impression being made by an inked ribbon.

Between 1941 and 1947 an automatic attachment for any ordinary half shadow saccharimeter fitted with a Lippich prism system was developed by the



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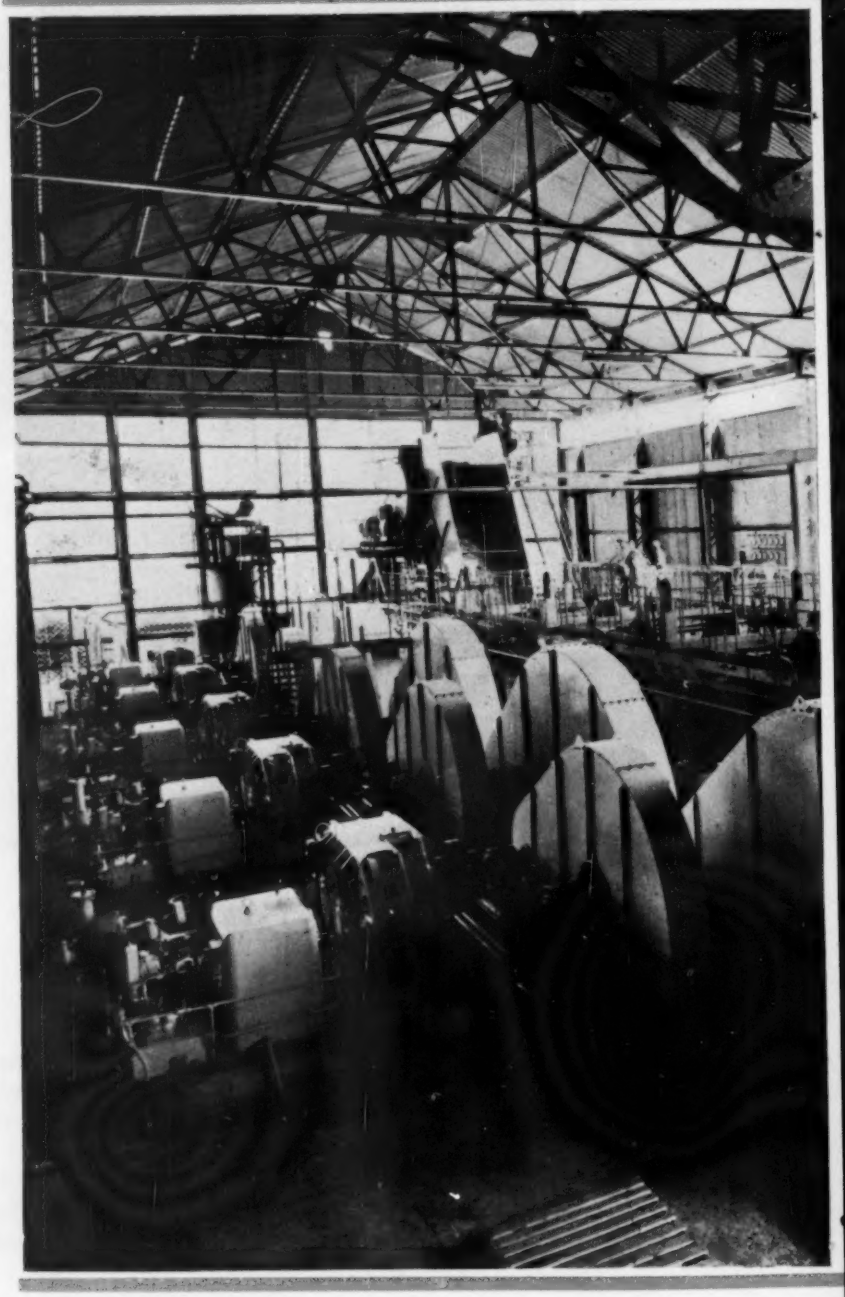

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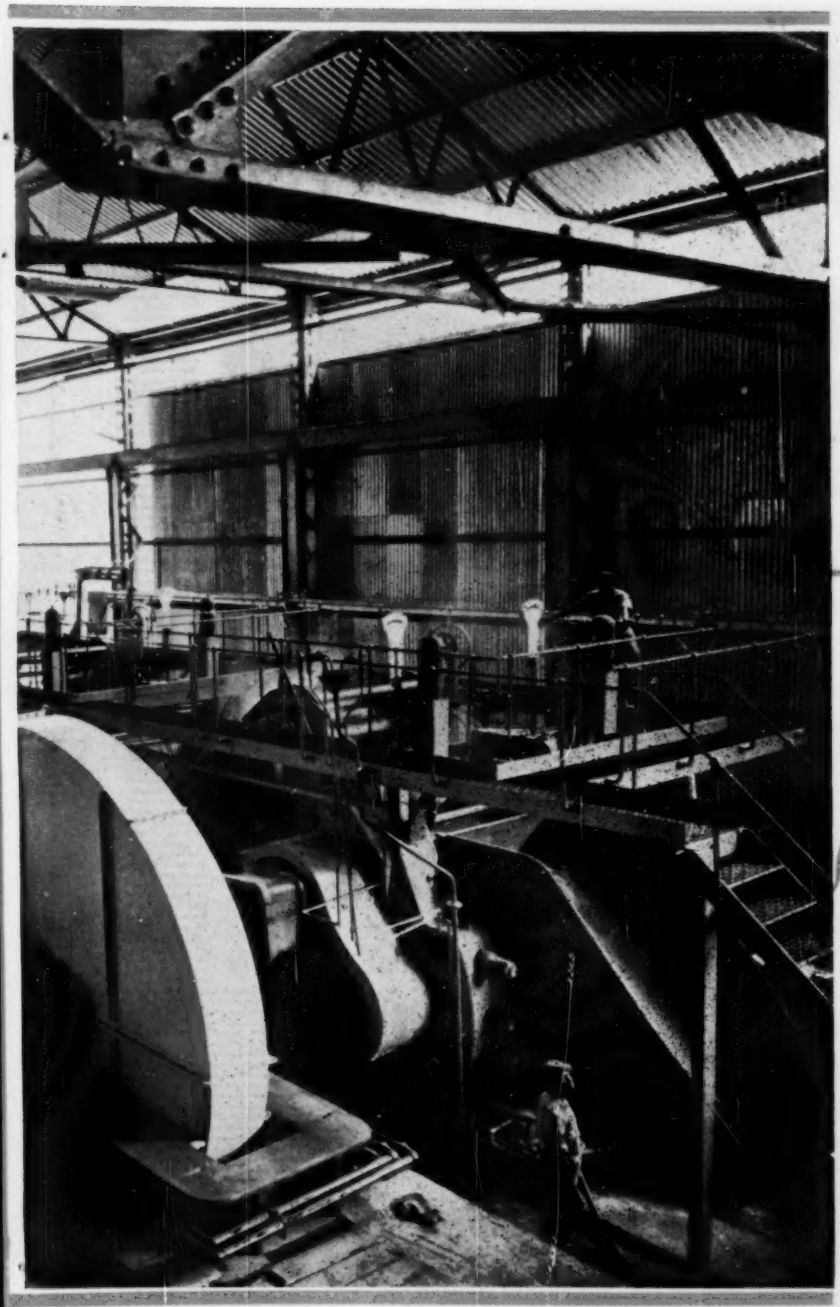
The illustration shows a modern 15 Roller 35" × 72" Sugar Cane Milling Plant with individual Turbine Drives recently supplied to Deep River-Beau Champ Ltd., Mauritius. The average grinding capacity figure for the 1958 crop was 103 tons canes per hour. Extraction 96.2%. Cane fibre content 12.5%.



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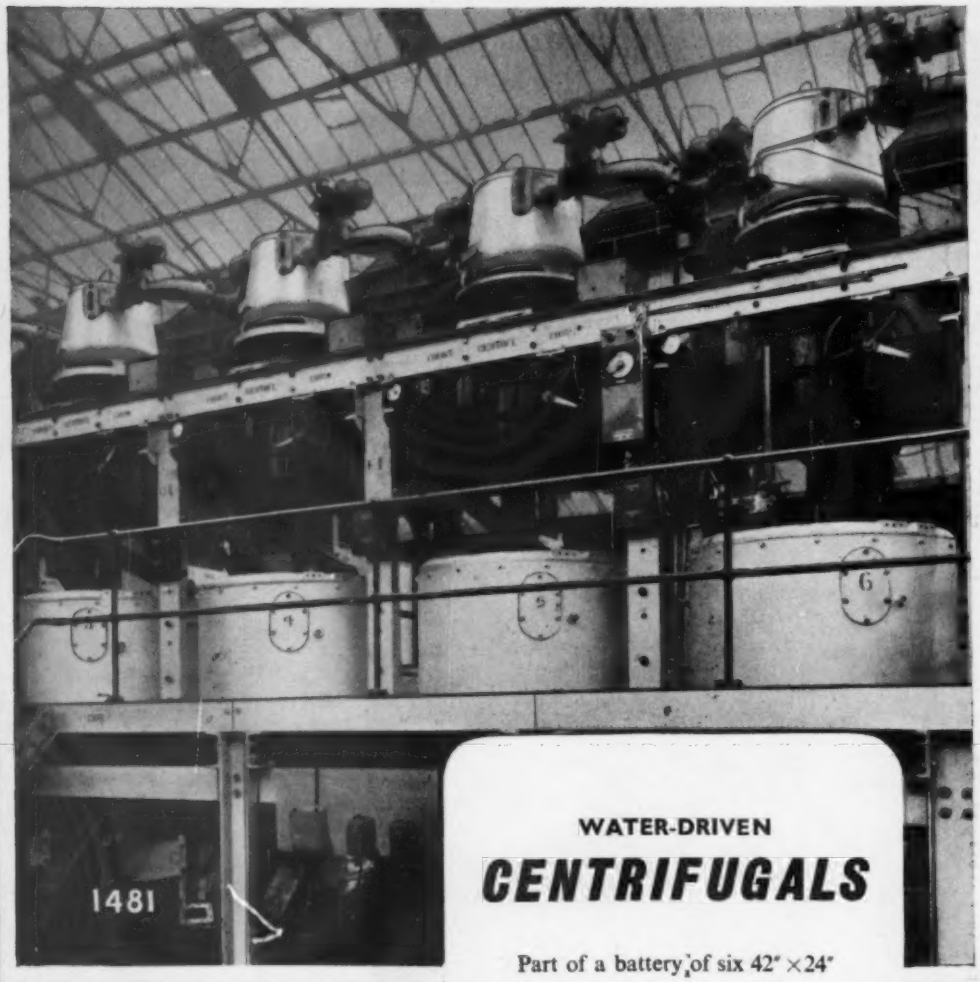

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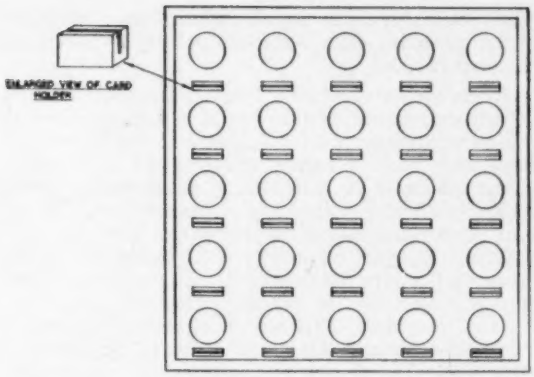


Fig. 3b

Spreckels Sugar Company of America and subsequently used by them in the tare laboratory at their Woodlands factory in California. This apparatus had a scanning device for setting the field automatically using a photocell amplifier and phase-sensitive motors[1]. It was claimed to be much more accurate than the visual instrument.

An automatic polariscope or saccharimeter using a photocell and null point setting on a milliameter is described by PARNUM and AITKEN but does not appear to have materialised in practice (British Patent 540,876).

After the second world war the investigation of a completely automatic instrument was taken up seriously by this Corporation. An experimental model, which showed promise, was produced for us by a firm of electronic engineers working in collaboration with optical experts, but this was still dependent upon manual balancing by photoelectric meter indicator[2].

In the meantime another leading manufacturer of scientific instruments produced a semi-automatic saccharimeter operating a coded disc and digitizer and display unit with binary coded output capable of operating a card-punch machine. This instrument was on trial at our Wissington factory in 1957/8 where the Hollerith punch card system was used experimentally and included beet weighing and tare recording[3].

Our search, however, still continued for a system which would be fully self-balancing and an approach was made to the National Physical Laboratory with the result that in 1958 they produced the automatic recording saccharimeter described by GATES[4], which was developed from the N.P.L. Precision Polarimeter. This employs the Faraday effect for making the fine setting of the plane of polarization independent of mechanical adjustments and the instrument therefore has no moving parts. The remarkable feature of the instrument was that due to its extremely high sensitivity, a test cell with a path length of only 0·75 mm and an aperture of 8 mm was necessary, giving an active volume of liquid required of about 0·021 ml only.

It has now been further developed by Ericssons Telephones Ltd., and is in production as the E.T.L.–N.P.L. Automatic Polarimeter type 143A after extensive trials during the 1958/9 campaign at three of our factories. Further instruments are to be purchased for use in our tare laboratories during the 1959/60 beet campaign. The instrument, illustrated in Fig. 4, consists of an automatic polarimeter, digital voltmeter and a display unit.

Fig. 4

[1] *I.S.J.*, 1948, **50**, 106; 1949, **51**, 93; 1952, **54**, 314.
[2] *I.S.J.*, 1955, **57**, 89.
[3] *I.S.J.*, 1957, **59**, 262.
[4] *I.S.J.*, 1959, **61**, 25.

A sample cell of 2 cm length has been finally agreed and sugar contents are obtained accurately to the second decimal place. In practice, however, they are 'rounded off' to the first decimal place for recording and payment to conform to the terms of the standard beet contract. The length of cell used will depend, of course, upon the optical rotation to be measured, the precision required, the absorption of the sample and some other factors. The new type of sample cell is depicted in Fig. 5. This shows the suction inlet (with filter mouth inside the beaker), outlet and cell holder.

(*Photo : Courtesy Ericssons Telephones Ltd.*)

Fig. 5

During the whole of the 1957/8 beet campaign, after initial difficulties had been successfully overcome, practically every sample was read at Wissington factory in an ordinary (Fric or Schmidt & Haensch) saccharimeter with visual setting and then in the E.T.L.–N.P.L. Automatic instrument, a total of nearly 30,000 samples in all. In making comparisons of this nature, especially when working at full speed, it is not possible to state which result is the correct one so that a tolerance of $\pm 0{\cdot}1\%$ of sugar was considered reasonable. Within those limits the average overall agreement was 96·4% and was as high as 99·6% in the last two weeks of the campaign. At Bury where over 12,000 special comparative tests were made an overall average of over 80% complete agreements were obtained and over 97% within $\pm 0{\cdot}1\%$ of sugar. It should be pointed out that the differences within this range are largely due to operators being unable to decide on which way to contract a reading in the second decimal place (i.e. to $\pm 0{\cdot}05\%$) on the scale of the visual instrument which the automatic saccharimeter probably does more consistently by virtue of its construction.

In the early stages rather larger differences occurred which were traced to a variety of causes, the chief of which were entrapped air bubbles. It will be realised that with such a comparatively short cell length minute bubbles or particles of solid matter could seriously affect the accuracy of the readings. Therefore the construction of the sample cell had to be very carefully designed to avoid these. Being only 1 cm in depth (2 cm in the new model) even hairs or fibres had an effect on the readings obtained as can be readily imagined. This second source of error was eliminated by introducing into the filling funnel a filter made from fine nylon cloth. In the later model, filling is done by suction, the test liquid being offered to the inlet tube and drawn in through the cell on opening the clip by a syphoning action and has proved very successful. The time taken for one complete operation is about 45 sec but in the latest model this is reduced to 30 sec. It is hoped that even this may be improved upon.

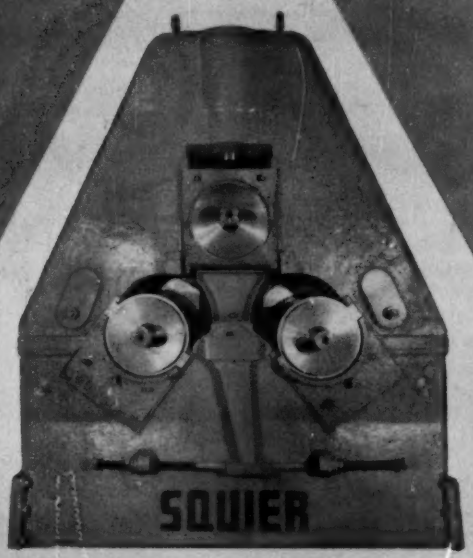
The ability to use sample cells of such short lengths enables measurements to be taken over a wide range of solutions which includes those having a high absorption. It is virtually impossible to obtain an accurate reading of such solutions in a visually balanced instrument.

One practical advantage of the E.T.L.–N.P.L. saccharimeter is, of course, that no dark room is required, but being sensitive to magnetic fields the instrument must be kept at least three feet away from any large moving pieces of steel or iron or other disturbing sources of magnetism.

It is not intended to give here complete details of the instrument but the following brief description, given by the makers, will be of interest.

The basic range of the instrument is $\pm 0{\cdot}5°$ of angular rotation with an ultimate precision of the order of $\pm 0{\cdot}0002°$ of arc. By suitably off-setting the zero, the polarimeter can examine angular rotations within its range of $\pm 0{\cdot}5°$ anywhere in the range 0 – $\pm 90°$. Take for example a sucrose solution of 100° I.S.S. in a 10 mm cell. This concentration has an angular rotation of 2·0345° arc, consequently an incremental concentration of 0·01° I.S.S. corresponds to an angular rotation of 0·0002°. By suitably off-setting the polarizer, the instrument will cover a range of 60–100° I.S.S. within its range of $\pm 0{\cdot}5°$ of angular rotation with an ultimate precision of $\pm 0{\cdot}01°$ I.S.S.

The complete instrument comprises an Optics Unit, and an Electronic Control Unit. The former consists of a vertical cylindrical column approximately 4 inches (102 mm) in diameter, mounted on a truncated conical base of maximum diameter 7 inches (180 mm), the overall height being approximately 25¼ inches (640 mm). This houses the light source, Polarizer, Modulator Faraday Cell, Compensator Faraday Cell, Analyser, and Photo-multiplier Cell Type EM16094B, arranged in that order, the light source



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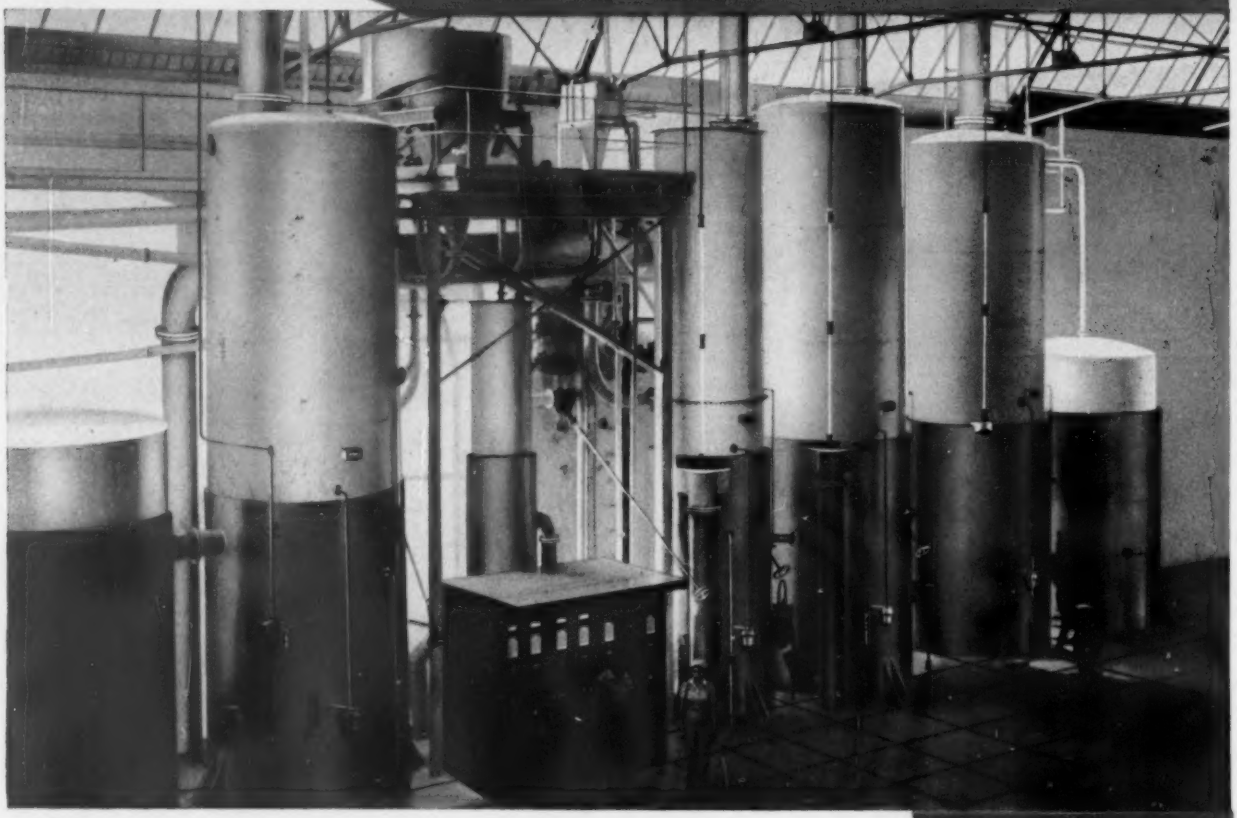

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	Classical process 1957/58	*Braunschweig juice purification* 1958/59
CaO in thin juice	95 mg/100°Bx	72 mg/100°Bx
Thick juice colour	15·4°St/100°Bx	5·9°St/100°Bx

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Fig. 6

being at the top of the instrument. A housing is situated between the Faraday cells to accommodate sample cells of up to 40 mm path length.

The Electronic Control Unit contains an A.C. Amplifier Frequency Rejection Filter, Phase Sensitive Detector, and D.C. Amplifier. It is mains operated and can be used on A.C. voltage ranges 100–125 and 200–250. Power supplies for the Optics Unit are all provided by the Control Unit via a multi-core inter-connecting cable, which also carries the output from the Optics Unit to the Control Unit.

This then operates a precision indicator, an illuminated digital display, a printing unit or, if required, a punch card machine such as the Hollerith system at our Wissington factory.

Figure 6 above shows an operator pouring a sample into the funnel of the polarimeter. The sugar content then automatically appears in the top panel of the cabinet. A plastic 'stub card' punched with the serial number of the sample is placed in the 'senser' seen on the right. The bar lever on this is pulled downwards towards the operator and this actuates the Hollerith machine which then punches the serial number and sugar content of the sample on the card which it ejects automatically. The machine is then ready for the next sample.

The instrument can be used for control purposes and was used successfully by us at our Peterborough factory for recording and controlling the losses on the R.T. diffuser by automatically regulating the inflow of diffusion supply water. But that is another story. So far as saccharimetry in the tare laboratory is concerned we now have automation 'de luxe' and something which surpasses even our wildest dreams.

ACKNOWLEDGMENTS.

The Author wishes to express his thanks to the Directors of British Sugar Corporation Limited for permission to publish this work and for the assistance of all those members of the Chemical Control Staff who have helped with it.

BRITISH SUGAR CORPORATION LTD.

12th TECHNICAL CONFERENCE.

The 1959 Technical Conference of the British Sugar Corporation Ltd. was held during the 10th–12th June 1959 at Harrogate, Yorkshire. In addition to the Works Managers and Executive and Technical staff of the Corporation, visitors were present from the Continent, including technologists from Austria, Belgium, Denmark, Eire, France, Germany, Holland, Italy, Sweden and Switzerland, and also representatives of Tate & Lyle Ltd., Westburn Sugar Refinery Ltd., Mirrlees Watson Co. Ltd. and the *International Sugar Journal.*

The Chairman, J. CAMPBELL MACDONALD, O.B.E. Executive Director and Chief Technical Officer of the Corporation, opened the Conference and welcomed the guests, thereafter discussing the achievements of the Corporation in the 1958/59 crop in comparison with previous years. The progress of the coming crop in Britain and the Continent was briefly discussed by Mr. MACDONALD and delegates; in most countries a fairly large crop was expected which, although not as large as 1958/59, was likely to prove an embarassment in some countries.

Following this, the first of the technical papers was read. Dr. A. CARRUTHERS described the work of the Corporation's Research Laboratory on the composition of beet juices and the changes taking place during processing. A number of techniques were described for the routine analysis of cationic, organic acid and nitrogenous components and which may be substituted for delicate and lengthy methods known hitherto. G. F. N. BATTLE, Executive Director of the Corporation, gave details of crop prospects for 1959/60 in greater detail than in the earlier discussion, and following this, N. M. ADAMS described the new Dorr-Oliver A.T.V. clarifier to be installed with rotary filters at two further white sugar factories in England. Experiments were described on the operation of rotary filters, and the construction of the carbonatation plant to be installed.

Dr. W. KRÜGER of Pfeifer & Langen K.G. described a rapid method for determining effective alkalinity by phosphoric acid titration; the method was used for finding out the reason for higher lime salts in one of two sugar factories. Experiments on the effect of temperature of preliming and main liming and of mud recirculation were described by Dr. P. MOTTARD of Montrouge, Belgium. The first day of the Conference closed with a dinner given by the Corporation to delegates.

The application of isotopes to industrial processes was the subject of a film produced by the Atomic Energy Authority and shown on the morning of the 11th June, after which J. F. T. OLDFIELD gave an account of the use of radio-isotopes in the study of sugar problems such as the degradation of fructose, carbohydrate formation in growing beets, etc. R. M. J. WITHERS then reviewed the final elements for automatic control in the British Sugar Corporation—valves, variable speed drives and miscellaneous feeders. After lunch, a visit was arranged to the ruined Abbey at Bolton Bridge and a tour of the countryside surrounding Harrogate.

On the 12th June, S. A. MORRISH presented a paper in which he described modern pulp presses and the results obtained in various countries with them. He gave preliminary results using a small-scale press of a type new to the sugar industry and of modifications made to the standard press used in the Corporation. This was followed by K. HAMPEL'S usual voluminous and comprehensive survey of steam and vapour distribution diagrams and representative week data for all the British factories during the 1959/59 campaign. The Chairman then summarized the Conference and brought it to a close.

The high standard of the papers and the lively discussions which followed them are of great value to the sugar industry and the Corporation are to be congratulated on assembling such an array of talent whose co-operative efforts have proved in the past to bring benefits to all.

REFRACTIVE INDICES OF PURE SUCROSE SOLUTIONS

By D. F. CHARLES (Technical Department, California & Hawaiian Sugar Refining Corporation, Ltd., Crockett, California).

ABSTRACT

SUGAR solutions were prepared using known weights of sucrose and water, then were read on a carefully calibrated Bausch and Lomb precision refractometer. The results are in agreement with recent determinations at the National Bureau of Standards and confirm previous findings that the International Scale (1936) of Refractive Indices for Sucrose Solutions is in error for solutions containing more than 60% sucrose.

INTRODUCTION

In 1936, the International Commission for Uniform Methods of Sugar Analysis[1] established the "International Scale of Refractive Indices of Sucrose Solutions." For the region above 60% solids the scale was a compromise between results of two investigators whose data were not fully concordant. A previous paper[2] showed that studies made in several laboratories were in general agreement that some revision of the International Scale was necessary.

The present paper describes a more extensive study of refractive indices in the range under question. The results are in general agreement with previous findings and indicate that the International Scale of 1936 gives results too high by 0·08% at 66% solids and by 0·20% at 80% solids.

PROCEDURE

General—Solutions were prepared from known weights of sugar and water. These were read on a Bausch and Lomb Precision Sugar Refractometer (catalogue No. 33–45–91, serial No. XD 7176, prism series 719). The refractometer has an arbitrary linear scale engraved on an arc ; a conversion table is provided to give refractive index and percent sucrose solids. The refractive index calibration was checked with distilled water and calibrated glass plates. Pycnometer measurements were made on many samples as an auxiliary check on the concentration of the weighed solutions.

1. *Sugar Used.* The sugar used for most of the calibrations was a high purity commercial sucrose, Confectioners Sanding sugar. Total impurities, aside from moisture, were of the order of 0·01%. Crystal size is indicated by a mean aperture of about 0·60 mm.

Several oven drying tests showed about 0·003% moisture to be present on the crystals of this sugar when stored under normal conditions. Because the dried sugar would pick up moisture rapidly during exposure to air, it appeared useless to dry it and keep

[1] LANDT : Referee's Report on Subject 7, *Proc. 9th Session ICUMSA*, 1936; *I.S.J.*, 1937, **39**, 225.
[2] CHARLES and MEADS : *Anal. Chem.*, 1955, **27**, 373.

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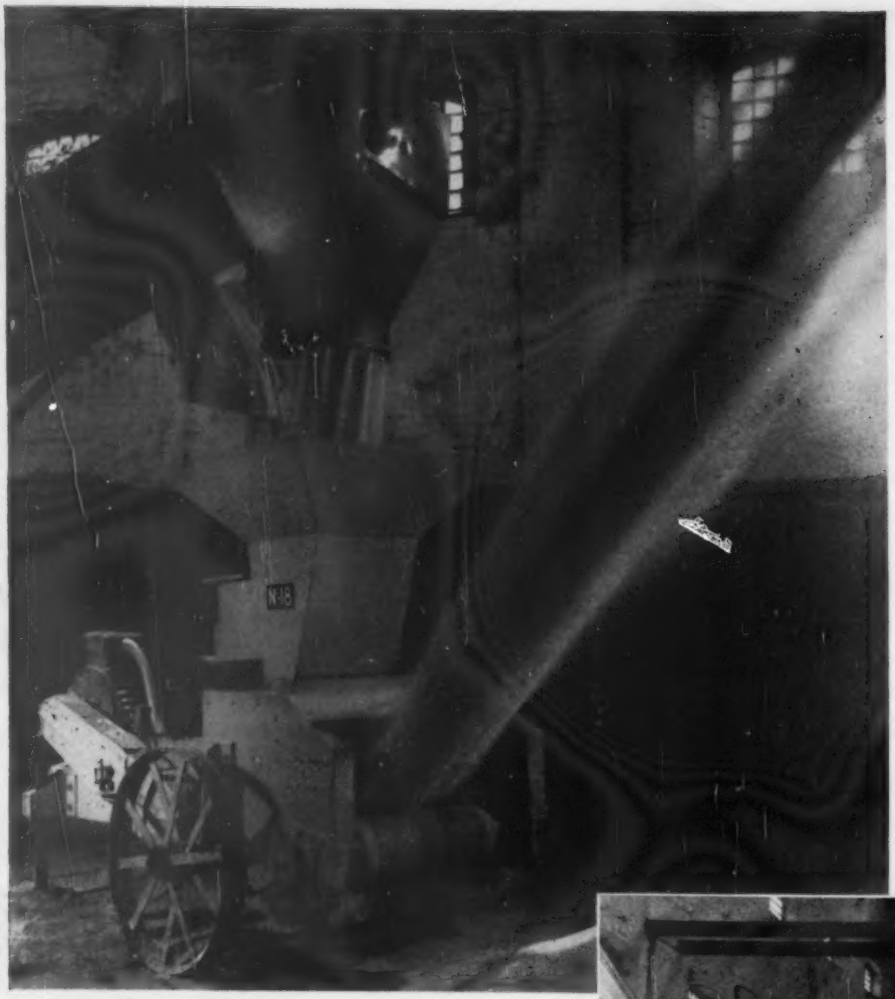

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it in a desiccator. In preparing solutions, the weights of the room equilibrated sugar were corrected for the 0·003% moisture.

Of additional concern was the possibility of sugar liquor being occluded within the crystals of sucrose[3,4]. HILL* recently determined the internal moisture content of a sample of this sugar to be 0·015%. The weights of sugar used in the various samples in this investigation have been corrected for this amount of internal moisture.

2. *Preparation of Sugar Solutions.* A 100 ml Erlenmeyer flask was tare weighed with its ground glass stopper. Sugar and water were added to the flask in turn, in amounts to give the desired density. The flask and contents were weighed after each addition. The Permas weights used were calibrated by comparison with a set of weights certified by the National Bureau of Standards.

The stopper was lubricated lightly with petrolatum and inserted in the flask. The closed flask was heated with occasional shaking in a water bath to ten to fifteen degrees above the saturation temperature. A C-clamp was used to hold the stopper in place during heating. After solution was completed, the contents of the flask were cooled to room temperature. Portions were then drawn off by eyedropper for refractometer reading. Samples were prepared covering the range from about 54% to 81% solids.

A second method, used on several occasions, gave results comparable to those from the method above. It consisted of weighing the flask, then the sugar and flask, adding the approximate amount of water required, and finally bringing the solution to a boil in the open flask for a few seconds. After boiling, the flask was cooled, stoppered, dried, weighed and shaken well, before the sample was withdrawn by eyedropper.

3. *Pycnometer Comparisons.* Pycnometer measurements were made on many of the samples. The pycnometer employed was a 25 ml conical specific gravity bottle with internal thermometer serving as a standard taper ground-glass joint stopper. The bottle has a side arm capillary with a vented ground joint cap. In calibrating the pycnometer with distilled water, it was necessary to extrapolate the weight back to zero time because of the evaporation of water through the vent.

Table I shows a comparison between the percent solids calculated from weights of sugar and water and the percent solids obtained from pycnometrically determined specific gravities using the conversion data given by BATES[5]. The samples listed in Table I are arranged in order of increasing percent solids with the code numbers of Column 1 identifying the order of preparation of the solutions. In order to make this comparison valid, the present results have been expressed in terms of percent solids in vacuo since this is apparently the basis of the conversion data[5].

Sample No. 21 (73·3% solids) gave pycnometer results significantly lower than the other samples. It is believed that this result was influenced by the presence of air bubbles in the solution. For several other solutions prepared at high concentration, pycnometric measurements were not made because of the high viscosity.

Table 1

Comparison of Solids Content of Sucrose Solutions Determined by Pycnometer with Solids Content Calculated from Weight Data.

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Solution code number	% Solids from measured weights in air	Correction to obtain weight % in vacuo	% solids from measured weights in vacuo (Col. 2 + Col. 3)	Apparent specific gravity (20°C/20°C) measured with pycnometer	% solids in vacuo from NBS C440 Table 114 and Col. 5	Difference Col. 6 minus Col. 4
32	53·999	—0·011	53·988	1·25439	54·000	+0·012
35	56·712	—0·011	56·701	1·27000	56·729	+0.028
36	62·238	—0·010	62·228	1·30256	62·272	+0·044
23	63·291	—0·010	63·281	1·30867	63·287	+0·006
30	64·034	—0·010	64·024	1·31331	64·055	+0·031
6	65·713	—0·010	65·703	1·32352	65·733	+0·030
5	66·254	—0·010	66·244	1·32675	66·261	+0·017
42	66·379	—0·010	66·369	1·32749	66·382	+0·013
3	66·454	—0·010	66·444	1·32809	66·482	+0·038
2	66·566	—0·010	66·556	1·32882	66·597	+0·041
43	66·587	—0·010	66·577	1·32888	66·607	+0·030
41	66·621	—0·010	66·611	1·32891	66·612	+0·001
37	66·626	—0·010	66·616	1·32913	66·648	+0·032
39	66·661	—0·010	66·651	1·32935	66·684	+0·033
44	66·669	—0·010	66·659	1·32938	66·689	+0·030
38	66·712	—0·010	66·702	1·32956	66·718	+0·016
1	66·742	—0·010	66·732	1·32983	66·761	+0·029
4	67·375	—0·010	67·365	1·33383	67·410	+0·045
8	67·833	—0·010	67·823	1·33669	67·872	+0·049
9	68·252	—0·009	68·243	1·33925	68·284	+0·041
11	68·764	—0·009	68·755	1·34241	68·792	+0·037
10	68·969	—0·009	68·960	1·34366	68·994	+0·034
12a	69·707	—0·009	69·698	1·34837	69·745	+0·047
14	70·476	—0·009	70·467	1·35317	70·509	+0·042
18	70·752	—0·009	70·743	1·35501	70·800	+0·057
13	70·786	—0·009	70·777	1·35516	70·824	+0·047
15	72·538	—0·009	72·529	1·36615	72·556	+0·027
21	73·257	—0·008	73·249	1·37047	73·230	—0·019
16	73·273	—0·008	73·265	1·37089	73·295	+0·030
17	74·417	—0·008	74·409	1·37829	74·447	+0·038

Survey of the column of differences (ignoring Sample No. 21) shows a trend (significant at the 5% level) toward higher deviations at higher concentrations. In the region between 65 and 70% solids, the average difference is about 0·035% solids. It is possible that this difference might indicate small errors in the fundamental density data. However, for our purposes, the pycnometric checks serve to indicate that the reproducibility of the prepared solutions was generally good.

4. *Refractometer Readings.* Careful technique was needed to obtain a sharp line in the refractometer. The sodium light source was adjusted to permit light rays to enter the liquid meniscus at the end of the prism space instead of passing through the auxiliary prism. A sharp critical line was obtained in this way.

An eyedropper was used to add the liquid slowly to the interprism space. Thus, only a small film of liquid was exposed to the air in the tubulature around the

* Address : Dr. S. HILL, Tate and Lyle Research Laboratory, Westerham Road, Keston, Kent, England.

[3] HILL and DOBBS : *Analyst*, 1958, **83**, 143.

[4] POWERS : *Nature*, 1956, **178**, 139.

[5] *Nat. Bureau Standards Circ.*, 1942, (C-440), Table 114, Col. 3.

neck of the dropper, minimizing evaporation. With prepared solutions of higher viscosity, the time required to fill the refractometer increased, e.g. from 20 seconds at 66% solids to about 15 minutes at 78% solids. For the longer time periods, a screw clamp was attached to the rubber bulb of the eyedropper. Pinching the clamp by degrees permitted controlling the rate of introduction of the liquid to correspond with the rate of spreading between prisms.

Above about 78% solids, periods of filling became too long and it was necessary to attempt to discharge the proper amount of liquid on the open prism face so that when the prisms were closed, the proper liquid surface was exposed to the light source and a good line was obtained. It became more difficult to obtain a sharp line at higher concentrations. Thus, about 80 or 81% solids appears to be the practical limit to accurate calibration of the refractometer by this method.

5. *Refractive Index Calibration.* In attempting to establish the basic relationship between percent solids and refractive index, it is important that the instrument read correctly in refractive index. Zero point corrections, based on distilled water readings, were applied to observations on both sugar solutions and test plates[5]. An additional correction was applied to the readings for sugar solutions, based on the scale errors in reading a triangular glass test plate certified by the National Bureau of Standards to have a refractive index of 1·46632. This determination was made on four separate occasions. This scale error averaged +0·014 scale units, equivalent to 0·000041 units of refractive index or 0·018% sucrose solids.

Auxiliary Tests

Several tests were made to study phenomena related to the reliability of results. The pycnometric measurements have already been mentioned. Succeeding sections deal with the other factors considered.

Tests for Decomposition

To estimate the extent of decomposition of the sugar solutions, reducing substance content (invert) was measured on many of the samples by the Striegler method[6]. This method is particularly applicable for amounts of invert sugar up to 0·25% on solids in the presence of large amounts of sucrose. Table II shows the reducing substance content for the solutions analyzed. This table includes all the solutions brought to the boil during preparation.

The maximum amount of reducing substances found was about 0·06% on solids. Using the de Whalley correction[7], this amount of decomposition would make a difference of about 0·001% solids in the refractometer results. Thus, the decomposition appears to be insignificant.

Effect of Additional Heating on Refractive Index

VanHook[8] has reported that, under certain conditions, refractive index changes with time. To determine whether such changes occurred during this investigation, a few additional tests were performed. The sugar solutions were sealed after the first set of refractometer readings and were then heated at various temperatures and times selected randomly. After this the solutions were cooled and read again on the refractometer. Table III lists the conditions and changes in reducing substance content and refractometric percent solids.

Table II
Reducing Substance Content of Test Solutions

Sample number	Reducing substance % on solids	Condition of preparation
8	0·008	Heated
9	0·005	Heated
10	0·006	Heated
11	0·019	Boiled—1 minute
12a	0·133	Boiled—8 minutes
12b	—	Boiled—45 seconds
13	0·010	Boiled—1 minute
14	0·024	Boiled
15	0·023	Boiled—1 minute
16	0·015	Boiled—30 seconds
17	0·015	Boiled—30 seconds
18	0·000	Heated—1 hour at 60°C
19	0·010	Heated
20	0·065	Boiled
21	0·009	Heated
22	0·038	Boiled
23	0·009	Heated
24	0·017	Heated
25	0·057	Heated
27	0·030	Heated
28	0·052	Heated
29	0·062	Heated
30	0·008	Heated
31	0·059	Heated
32	0·009	Heated
33	0·048	Heated
34	0·021	Heated
36	0·000	Heated

Table III
Effects of Additional Heating on Test Samples

Sample No.	Heating conditions: Temp. °C	Heating conditions: Hrs. of heating	Change in: Reducing substances %	Change in: Observed refractometric solids %	Final pH
11—first heating	80	0·75	——	—0·005	——
11—second heating	75	2·5	+0·089	+0·144	6·0
12a	75	4·75	+0·31	+0·018	6·4
13	73	1·5	+0·010	+0·003	6·8
14	70	1·0	—0·001	—0·008	6·6
15	60	4·0	+0·005	0·000	6·6
16	80	3·0	+0·75	+0·006	5·0
17	80	1·0	+0·105	—0·040	5·8
18—first heating	80	2·0	+0·144	+0·001	6·3
18—second heating	80	2·0	+0·151	+0·004	6·4
19	85	1·05	+0·034	+0·004	6·4
21	90	1·0	—0·131	—0·006	6·0
23	60	5·5	+0·004	+0·009	7·0
24	60	3·0	+0·008	—0·006	6·5
30	56	68·0	+0·090	+0·016	6·0
32	65	3·0	+0·007	—0·008	6·4
33	65	3·0	+0·011	—0·008	6·1

[6] Bates and Jackson: *Nat. Bureau Standards Sci. Paper*, 1916, (268), 80.
[7] *I.S.J.*, 1935, **37**, 353.
[8] Personal communication.

★ The illustration shows a Horseley-Piggott Pressed Steel Tank which was supplied to the Dearne Valley Water Board.

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The changes in refractometer readings appear significant only in the case of the second heating of Sample No. 11 and the heating of Sample No. 17. There seems to be no evident explanation for these particular changes.

In general, it would appear that extended heating does not cause measurable changes in refractive index. We can be fairly confident, then, that the heating to dissolve the test samples, which was generally less strenuous, did not affect the observed refractometer readings.

Table IV

Refractive Indices of Sucrose Solutions Showing Deviations of Observed Points from the Equation :

$$n_D^{20} = 1{\cdot}337253 + 0{\cdot}00122215p + 8{\cdot}6899 \times 10^{-6}p^2$$

(1)	(2)	(3)	(4)	(5)	(6)
Solution code number	% solids calculated from weights in air	Refractive Index n_D^{20} Measured	Calculated	Observed minus calculated refractive index $\times 10^5$	Deviation in terms of % solids
32	53·999	1·42861	1·428587	+2·3	+0·010
35	56·712	1·43454	1·434512	+2·8	+0·013
36	62·238	1·44704	1·446978	+6·2	+0·027
23	63·291	1·44936	1·449414	—5·4	—0·023
30	64·034	1·45117	1·451144	+2·6	+0·011
6	65·713	1·45509	1·455089	+0·1	+0·000
5	66·254	1·45631	1·456370	—6·0	—0·025
42	66·379	1·45666	1·456667	—0·7	—0·003
3	66·454	1·45688	1·456846	+3·4	+0·014
2	66·566	1·45705	1·457112	—6·2	—0·026
43	66·587	1·45718	1·457162	+1·8	+0·008
41	66·621	1·45718	1·457243	—6·3	—0·027
37	66·626	1·45725	1·457255	—0·5	—0·002
39	66·661	1·45730	1·457338	—3·8	—0·016
47	66·665	1·45731	1·457348	—3·8	—0·016
44	66·669	1·45735	1·457357	—0·7	—0·003
45	66·701	1·45744	1·457434	+0·6	+0·003
38	66·712	1·45736	1·457459	—9·9	—0·042
1	66·742	1·45756	1·457531	+2·9	+0·012
4	67·375	1·45903	1·459042	—1·2	—0·005
8	67·833	1·46017	1·460140	+3·0	+0·013
9	68·252	1·46116	1·461147	+1·3	+0·005
11	68·764	1·46241	1·462383	+2·7	+0·011
10	68·969	1·46291	1·462878	+3·2	+0·013
12a	69·707	1·46466	1·464670	—1·0	—0·004
14	70·476	1·46660	1·466547	+5·3	+0·022
18	70·752	1·46723	1·467223	+0·7	+0·003
13	70·786	1·46739	1·467306	+8·4	+0·034
15	72·538	1·47163	1·471629	+0·1	+0·000
21	73·257	1·47345	1·473419	+3·1	+0·013
16	73·273	1·47351	1·473459	+5·1	+0·020
26	73·767	1·47475	1·474694	+5·6	+0·022
17	74·417	1·47641	1·476326	+8·4	+0·034
19	76·387	1·48130	1·481314	—1·4	—0·006
20	77·810	1·48494	1·484960	—0·2	—0·001
22	78·486	1·48673	1·486705	+2·5	+0·010
27	79·340	1·48892	1·488919	+0·1	+0·000
12b	79·931	1·49031	1·490460	—15·0	—0·058
34	80·431	1·49177	1·491768	+0·2	+0·001
29	80·970	1·49324	1·493182	+5·8	+0·022
Standard deviation				±4·9	±0·020

Results

Table IV lists the experimental results. Test solutions are listed in order of increasing concentration while the numbers of Column 1 refer to the order of preparation. Column 2 gives the % sucrose calculated from the known weights in air. Column 3 gives the refractive index results from the refractometer.

From the experimental data, the following equations were computed in which the sum of the squares of the refractive index deviations were minimized :

1. $n_D^{20} = 1{\cdot}337253 + 0{\cdot}00122215p + 8{\cdot}6899 \times 10^{-6}p^2$

2. $n_D^{20} = 1{\cdot}351494 + 0{\cdot}0057968p + 0{\cdot}0000182621p^2 - 4{\cdot}7114 \times 10^{-8}p^3$

Where n_D^{20} = refractive index
p = % sucrose by weight

(It should be noted that in neither case does the first term represent the refractive index of water. These equations are valid only in the range of the test measurements.)

The reduction in the residual variance by inclusion of the third degree term (Equation 2) was significant at the 5% level. However, Equation 1, on extrapolation, comes closer to the values heretofore accepted at low concentrations[1]. Until some logical scheme is developed for tying the new data in with those of the 1936 scale, Equation 1 seems to be the most useful representation of the data of the present study. Hence, Table IV shows, in column 4, the values of refractive index calculated from Equation 1. Column 5 shows the differences of these values from the observed data and Column 6 the equivalent % solids differences. The standard deviation of these differences is about 5×10^{-5} in units of refractive index or about 0·02% solids.

Table V

Refractive Indices of Sucrose Solutions Calculated for unit increments of % Solids from the equation :

$$n_D^{20} = 1{\cdot}337253 + 0{\cdot}00122215p + 8{\cdot}6899 \times 10^{-6}p^2$$

% Solids		Refractive Index
50		1·420086
51	....	1·422185
52	....	1·424303
53	....	1·426438
54	....	1·428590
55	....	1·430759
56	....	1·432946
57	....	1·435150
58	....	1·437371
59	....	1·439610
60	....	1·441867
61	....	1·444140
62	....	1·446431
63	....	1·448739
64	....	1·451065
65	....	1·453408
66	....	1·455769
67	....	1·458147
68	....	1·460542
69	....	1·462955
70	....	1·465385
71	....	1·467832
72	....	1·470297
73	....	1·472779
74	....	1·475279
75	....	1·477796
76	....	1·480330
77	....	1·482882
78	....	1·485451
79	....	1·488037
80	....	1·490641
81	....	1·493262
82	....	1·495901
83	....	1·498557
84	....	1·501230
85	....	1·503921

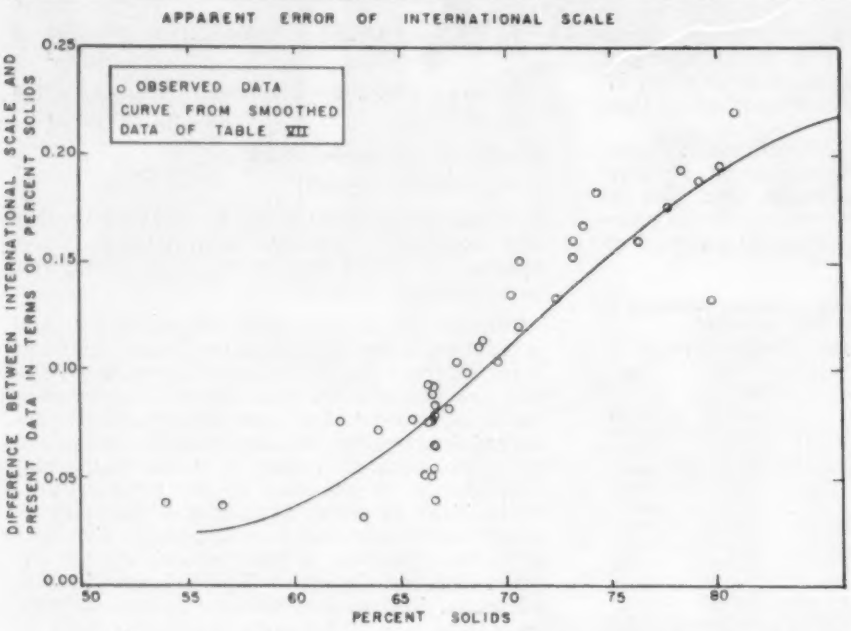

Table V shows values of refractive index for unit increments in % solids from Equation 1. Here, as in other tables, the values are carried out to six decimals to aid in the statistical evaluation of the results.

It is of interest to note how the new data compare with those of the International Scale of 1936. For this purpose, the International Scale values between 50 and 85% were extended beyond the fourth place using orthogonal polynomials to produce the smoothed table of refractive index values shown in Table VI.

Table VII was then prepared to show the differences between the smoothed scales in units of refractive index and % solids. The data from the last column of Table VII were used to draw the smooth curve of Fig. 1. Finally, the deviations of the observed points from the smooth curve (Column 6, Table IV) were plotted. Thus, Figure 1 permits a visual comparison of the magnitude of experimental error with the magnitude of the apparent error in the International Scale. The latter appears to give results too high by 0·08% at 66·6% solids and 0·19% at 80% solids with uncertainty in these figures of about ±0·02% solids. This is essentially the magnitude of the error found in the International Scale by other observers[10].

Table VI

Smoothed International Scale

(1) % Solids	(2) 1936 Int. Scale	(3) Smoothed	(4) Tabulated minus calculated refractive index × 105	(5) Deviation in terms of % solids
50	1·4200	1·419991	+0·9	+0·004
51	1·4221	1·422106	—0·6	—0·003
52	1·4242	1·424234	—3·4	—0·016
53	1·4264	1·426377	+2·3	+0·011
54	1·4285	1·428534	—3·4	—0·016
55	1·4307	1·430706	—0·6	—0·003
56	1·4329	1·432892	+0·8	+0·004
57	1·4351	1·435093	+0·7	+0·003
58	1·4373	1·437309	—0·9	—0·004
59	1·4396	1·439540	+6·0	+0·027
60	1·4418	1·441786	+1·4	+0·006
61	1·4441	1·444047	+5·3	+0·023
62	1·4464	1·446324	+7·6	+0·033
63	1·4486	1·448617	—1·7	—0·007
64	1·4509	1·450926	—2·6	—0·011
65	1·4532	1·453250	—5·0	—0·026
66	1·4555	1·455591	—9·1	—0·039
67	1·4579	1·457948	—4·8	—0·020
68	1·4603	1·460321	—2·1	—0·009
69	1·4627	1·462712	—1·2	—0·005
70	1·4651	1·465118	—1·8	—0·008
71	1·4676	1·467542	+5·8	+0·024
72	1·4700	1·469982	+1·8	+0·008
73	1·4725	1·472441	+5·9	+0·024
74	1·4749	1·474917	—1·7	—0·007
75	1·4774	1·477410	—1·0	—0·004
76	1·4799	1·479921	—2·1	—0·008
77	1·4825	1·482449	+5·1	+0·020
78	1·4850	1·484996	+0·4	+0·016
79	1·4876	1·487561	+3·9	+0·015
80	1·4901	1·490144	—4·4	—0·017
81	1·4927	1·492745	—4·5	—0·017
82	1·4954	1·495365	+3·5	+0·013
83	1·4980	1·498004	—0·4	—0·017
84	1·5007	1·500662	+3·8	+0·014
85	1·5033	1·503339	—3·9	—0·015

Table VII

Comparison of Present Data and International Scale

% Solids	Refractive Index: Present data from Table V	Refractive Index: Smoothed Int. Scale Table VI	Present data minus International Scale of 1936: In units of refractive index × 10^{-5}	Present data minus International Scale of 1936: In % solids units
55	1·430759	1·430706	+ 5·3	+0·024
60	1·441867	1·441786	+ 8·1	+0·036
65	1·453408	1·453250	+15·8	+0·068
70	1·465385	1·465118	+26·7	+0·110
75	1·477796	1·477410	+38·6	+0·154
80	1·490641	1·490144	+49·7	+0·192

Figure 1 indicates that a small deviation from the International Scale may remain in the region of 50 to 60% solids. In fact, extrapolation of either Equation 1 or Equation 2 to concentrations below 55% solids again results in increased deviations. Thus, before a continuous revised scale can be developed, it appears that experimental work in this intermediate concentration range may be necessary.

[10] SNYDER : Referee's Report on Subject 7, U.S. Nat. Comm. ICUMSA, April 1958.

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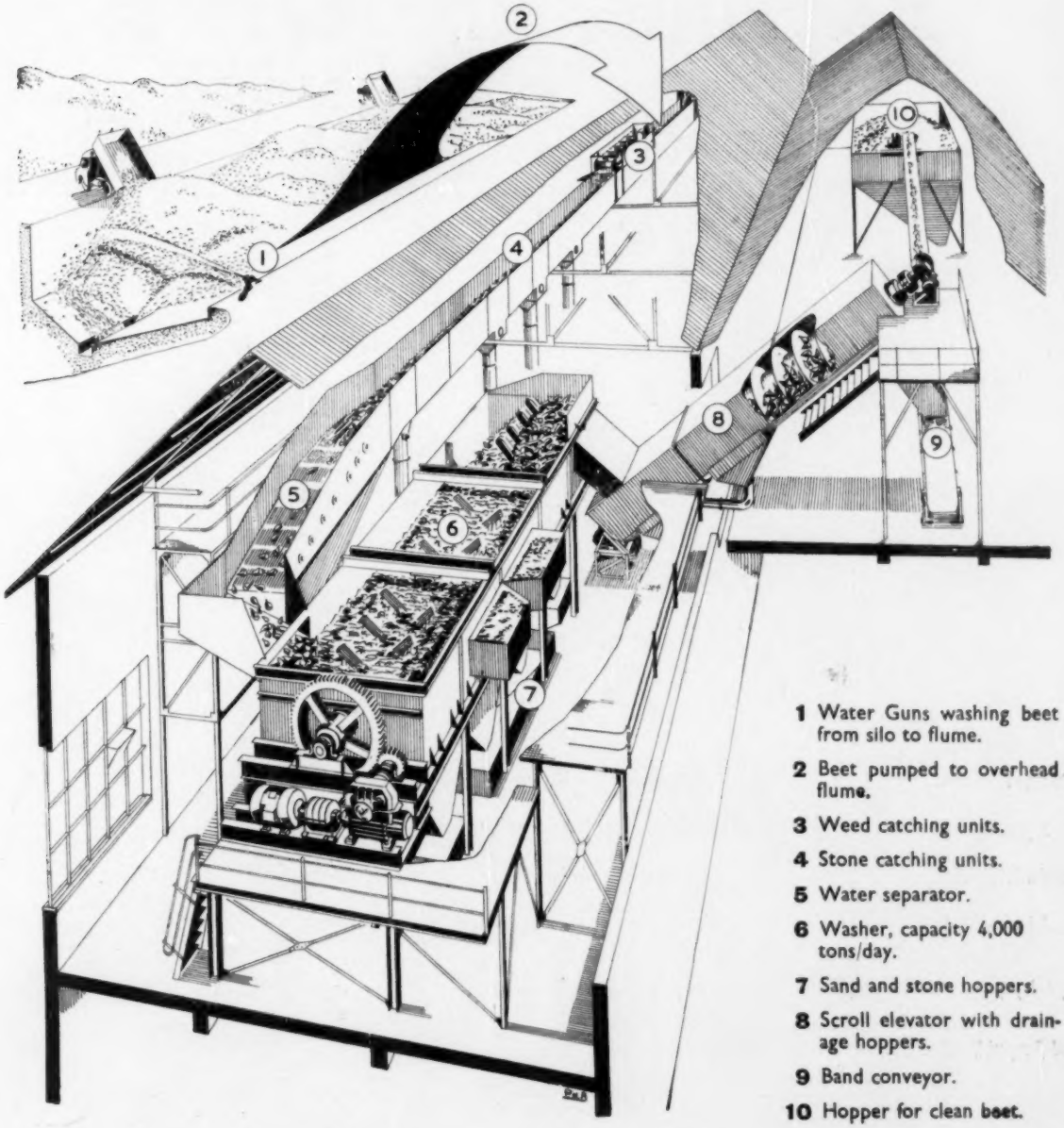

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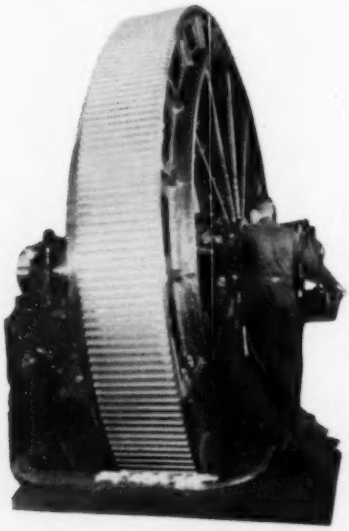

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Crystallization with Molasses, its Practice and Advantages. G. ALEMÁN HIDALGO. *Mem. XXXI Conf. Asoc. Técn. Azuc. Cuba*, 1957, 135–141.—Initial difficulties with the technique of crystallization with molasses have been resolved by careful attention to : (i) strict control of supersaturation by instrumentation, (ii) adequate proportions between crystals and the mother liquor, and (iii) supersaturation of the mother liquor. In regard to (ii) details are given of the quantity of powdered sugar employed and the technique used for shock seeding, while in (iii) the importance of maintaining supersaturation in the metastable zone is emphasized. The author's factory uses a boiling point elevation instrument for measurement of supersaturation and in 1957 the amount of sugar crystallized was raised to 99·66% of that available according to the Winter-Carp formula, compared with an average of 98·18% for the period 1954–1956.

* * *

Analytical Control of Pan Operation. M. A. SUÁREZ CARREÑO. *Mem. XXXI Conf. Asoc. Técn. Azuc. Cuba*, 1957, 155–163.—Calculations of boiling house quantities are presented, based on syrup, massecuite and molasses purities and proportions of footings, etc. They indicate the fact that recirculation of molasses does give a lower final molasses purity and increases sugar extraction. Other features arising with recirculation are also discussed, including the effect on apparent purity of inversion when molasses recirculation is practiced.

* * *

Intermediate Carriers. A. ARVESÚ GASSET. *Mem. XXXI Conf. Asoc. Técn. Azuc. Cuba*, 1957, 165–170.—The various classes of intermediate carriers—sliding, slat-and-chain, and drag-type—are reviewed and the best considered to be a modified Ewart drag-type. The modifications concerned are described and the advantages discussed.

* * *

Graphs of the Relative Speeds of Motors and Rolls in a Tandem. E. DEL VALLE PONS. *Mem. XXXI Conf. Asoc. Técn. Azuc. Cuba*, 1957, 171–179.—Provided the number of teeth in the gearing between a prime mover and the mill is not altered, the speed of rotation of the prime mover is directly related to the linear speed of the driven roll surface. A set of these relationships has been calculated for a tandem—two crushers and five mills—and the values drawn on a graph for rolls of 34, 35, 36 and 37 inches dia. The graphs are useful in obtaining the roll speed directly from engine speed without a laborious calculation.

* * *

Arrangement of the Trash Turner or Turnplate in the Mills by Means of a Template. L. A. LEMOINE. *Mem. XXXI Conf. Asoc. Técn. Azuc. Cuba*, 1957, 181–182.—The template is made at the same time as the profile of the turnplate is drawn. One side of the template corresponds to the surface of the turnplate, while two parallel sides are drawn vertically from the point of contact of the turnplate surface with the outer periphery of the mill grooving and from the rear end of the turnplate. The fourth side of the template is perpendicular to the two parallel sides, i.e. is horizontal, and if extended, forms a tangent to the feed roller periphery. When adjusting the turnplate, it is moved into such a position that this last side of the template is horizontal and would be tangential to the roller if extended.

* * *

Juice Flow in Cane Mills. H. ROJAS DE LA CAMPA. *Mem. XXXI Conf. Asoc. Técn. Azuc. Cuba*, 1957, 193–202.—A study has been made of juice extraction *vs.* compression in a three-roller mill and compared with data obtained with a hydraulic press. Results are illustrated graphically and from them is calculated the juice flow in the 1st, 3rd and 4th mills. These are also illustrated graphically, and it is concluded that at some point, the direction of flow changes from counter to the bagasse blanket to co-current. This change of direction governs the efficiency of juice extraction and an "extraction law" is proposed : "The distance of the (flow) inversion zone from the point of maximum compression determines the efficiency of the mill". The importance of high compression in compensating for retention of juice by the bagasse blanket is emphasized.

* * *

Perfect Lubrication of the Trunnion Journals in the Light of Classical Hydrodynamic Theory. U. VILLAR LORENZO. *Mem. XXXI Conf. Técn. Azuc. Cuba*, 1957, 203–211.—The principles of lubrication (in order to substitute fluid friction for sliding friction) are discussed with particular reference to the work of TOWER and REYNOLDS.

* * *

General Study of Trunnion Journals. U. VILLAR LORENZO. *Mem. XXXI Conf. Asoc. Técn. Azuc. Cuba*, 1957, 213–220.—The types of bearings are discussed briefly, and the kinds of journals and their materials of construction surveyed. Factors affecting their performance are discussed, together with the methods of lubrication.

* * *

Localization of Fatigue and Reduction of Failures to the Minimum. A. E. FELDT. *Mem. XXXI Conf. Asoc. Técn. Azuc. Cuba*, 1957, 221–223.—Reference is made to non-destructive methods of examination used to make regular tests for fatigue cracks, etc.

* * *

Technological Experimental Miscellanies. C. M. ALONSO. *Mem. XXXI Conf. Asoc. Técn. Azuc. Cuba*, 1957, 235–239.—Subjects mentioned include plastic steel, which was found to be resistant to high pressures and temperatures and to juice corrosion ; improvement in bagasse disintegration by reducing the width of a crusher which had been wider than the mills;

and the quantity and temperature of maceration water. Mill settings and dimensions at the author's factory are tabulated.

* * *

Utilization of the Ion Exchange Process in Sugar Refining. V. The Physical Strength of Ion Exchange Resins. S. IWASHINA. *Proc. Research Soc. Japan Sugar Refineries Tech.*, 1958, **7**, 74–83.—Samples of resins, in the form used in the refining process, were screened to 20–30 mesh size and 50 g samples vibrated during 5 hr with 50 cc of water containing 12 hard glass beads. The unbroken resin particles were collected on a 30-mesh screen and the strength factor defined as the percentage resin remaining. Results are tabulated and the resins illustrated.

* * *

Continuous Carbonatation. N. FURUKAWA. *Proc. Research Soc. Japan Sugar Refineries Tech.*, 1958, **7**, 84–90.—With some raws, colour removal increased with increasing lime dosage while it was not affected in the case of other raws. In some cases colour and pH of first carbonatation were directly related but in one case colour remained constant below pH 9·4 while in another it increased below about pH 9·2. When the degree of carbonatation was greater than 94%, colour increased with increased retention time ; below 94% the curve of colour *vs.* flow rate (the inverse of retention) was parabolic. The optimum temperatures in first, second and third tanks are 55, 65 and 75°C respectively.

* * *

Manufacture of Powdered Sugar by "Atomizer", a Crushing Mill Giving Highly Powdered Sugar. K. KIMURA and K. NARUMI. *Proc. Research Soc. Japan Sugar Refineries Tech.*, 1958, **7**, 99–102.—The "Atomizer" hammer mill is described and its use discussed. The unit comprises a pair of discs carrying hammers between them, the assembly rotating at 6000–10,000 r.p.m. in a casing, part of which is a lining plate with a serrated surface, and part a screen through which passes the powdered sugar.

* * *

Report on a Thermal Power Station in a Sugar Refinery. S. OGURA. *Proc. Research Soc. Japan Sugar Refineries Tech.*, 1958, **7**, 103–106.—An emergency stand-by turbogenerator has been brought into regular use to increase power output; details are given of the method and effects of driving the unit, with diagrams of steam flow, etc.

* * *

Tests on an Escher Wyss Continuous Centrifugal Type C-4-4. T. TAKAMATSU. *Proc. Research Soc. Japan Sugar Refineries Tech.*, 1958, **7**, 107–109.—Affination trials were carried out using the continuous machine and data obtained are tabulated. The affination capacity was equal to that of 5 vertical machines and required less than half the labour and electric power.

Report on a Test Run of the "Hydromat" Continuous Flow Centrifugal for Final Massecuite .T. MATSUZAWA. *Proc. Research Soc. Japan Sugar Refineries Tech.*, 1958, **7**, 110–113.—A Hein Lehmann "Hydromat" continuous centrifugal was operated at 2600 r.p.m. for final massecuites, with a screen plate of 0·09 mm slit width. Massecuite was heated to 50°C just before spinning. Suitable throughput was 1·3 tons/hr; the centrifuging time was 15 seconds and the layer thickness about 2 mm. The motor current consumption was about 45A.

* * *

New Techniques and Trends in Taiwan Sugar Manufacture, 1957. C. A. LEE. *Taiwan Sugar*, 1958, **5**, (11), 27–29.—With cultivation of N:Co 310, the clarification stations of Taiwan factories were overloaded and sugar quality deteriorated. Success in improving filtrability, colour and ash content was achieved by : addition of 350 p.p.m. of phosphate (as "Ehrmannite"); replacement of part of the lime added with NaOH ; introduction of seeding with icing sugar/alcohol slurry; and addition of Na_2CO_3 to the second carbonatation juice.

* * *

Drought Conditions and Juice Characteristics. I. The Effect of Environment and Field Conditions on Mud Volume. J. R. MCFARLANE. *Proc.* 1957 *Meeting B.W.I. Sugar Tech.*, 51–61.—Juice samples collected over the past 3 years in which drought occurred were treated with the equivalent of 200 p.p.m. P_2O_5, limed cold to pH 8·3, heated to boiling with constant slow agitation and settled for 60 minutes in a steam chamber. The mud volume was taken as a measure for comparison between samples from different soils, varieties, etc., and the effects of each factor are described. Soil type, age of cane at reaping, and juice purity could not easily be correlated with % mud volume, particularly in view of the paucity of data. It is evident that varietal differences play a considerable part in ease or difficulty of clarification.

* * *

Scale Formation on Heating and Cooling Surfaces. J. I. CHANDLER. *Proc.* 1957 *Meeting B.W.I. Sugar Tech.*, 105–111.—Work has been carried out on the "critical heat transfer rate" for various surfaces in solutions of Na_2HPO_4. Applications to the design of evaporators, crystallizers and heat exchangers are briefly discussed.

* * *

Wire Mesh Entrainment Prevention. Sir JOHN SAINT, F. HUTCHINS and F. C. HUTSON. *Proc.* 1957 *Meeting B.W.I. Sugar Tech.*, 113–115.—A wire mesh entrainment separator installed on the last effect of an evaporator was successful in reducing entrainment to a negligible amount. The upper limit of vapour velocity is 35 f.p.s. Advantages include high free volume and impingement surface; easy installation, and negligible pressure drop. A hard scale formed, penetrating the mesh to about ¾ inch during 14 weeks. The analysis of the scale is similar to that found in evaporator final effects.

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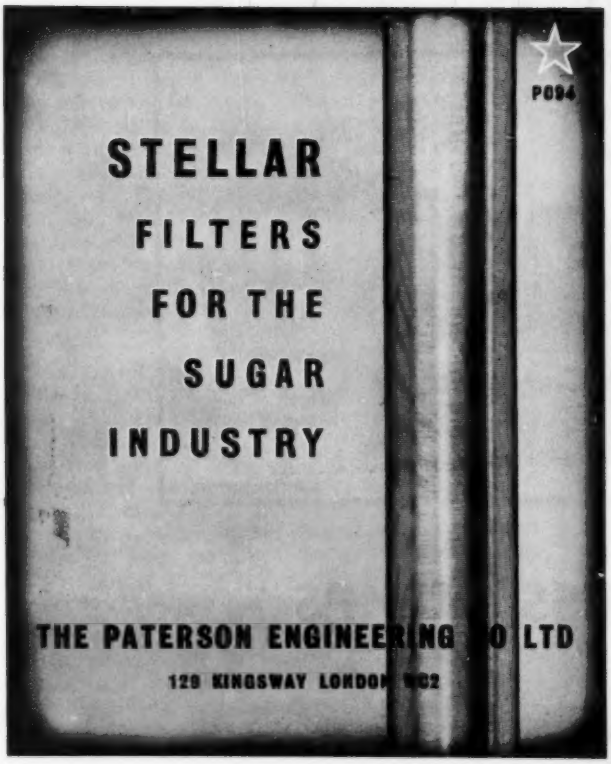

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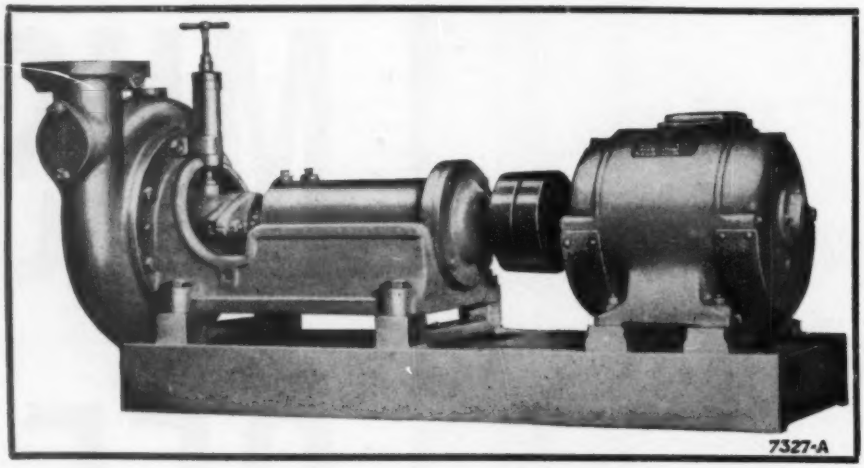

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Chemical Control of Clarification Reactions. M. C. BENNETT. *Proc.* 1957 *Meeting B.W.I. Sugar Tech.*, 116–119.—The phenomena of flocculation, re-dispersion and reflocculation which occur when juices are limed and heated to boiling are briefly discussed.

* * *

Graining for Low Purity Massecuites. Sir JOHN SAINT and F. HUTCHINS. *Proc.* 1957 *Meeting B.W.I. Sugar Tech.*, 127–132.—A method was developed for counting the number of crystals in a slurry prepared in a ball mill, using methylated spirits as the fluid. The slurry was added to a weighed amount of 71·5°Bx syrup and the weight found by difference. After shaking for 6 hr, more 71·5°Bx syrup was added and the grain enlarged further by shaking overnight. The slurry was diluted with 69°Bx syrup and 2 ml placed between two glass plates. The area was measured and the number of crystals per unit area measured with a microscope of 2 sq.mm. field. From these figures the number of crystals in the original could be calculated. The effect of time of grinding, type of mill, etc., was examined, and the effect of varying amounts of slurry added in seeding a C-massecuite. In all cases (except where sufficient slurry was added), spontaneous grain formation occurred to bring the number of crystals in the massecuite to 1×10^6 per ml.

* * *

Production of Footings by the Full Seeding Method. J. G. H. BADLEY. *Proc.* 1957 *Meeting B.W.I. Sugar Tech.*, 133–135.—An account is given of the technique used at Searles factory, Barbados, where a slurry of powdered sugar in methylated spirit, produced in a ball mill and containing 10^9 nuclei per ml, is used for seeding C-massecuite, the boiling being controlled by use of a refractometer. Condenser water return to the pan body permitted the water content of the mother liquor to be held constant while obtaining vigorous circulation due to boiling.

* * *

Performance of the Duckenfield Evaporator. R. W. TURNER and E. J. MOL. *Jamaican Assoc. Sugar Tech. J.* 1957, **20,** 44–46.—As a result of the changing of feed to the twin first effect vessels from series to parallel flow; replacement of an 8-inch live steam make-up valve by a 12-inch valve and automatic desuperheater; and installation of a preheater between the evaporator supply pump and evaporator, the overall evaporation rate has been increased from 6·07 to 6·33 lb/sq. ft./hr and that of the first effect from 4·74 to 5·73 lb/sq.ft./hr.

* * *

Reconstruction at Central Araujo. R. P. PUERTAS. *Sugar J.* (La), 1959, **22,** (8), 37–38.—The modernization programme since 1953 has included a truck system for cane haulage instead of the public railroad; replacement of open defecators and presses by an Ibáñez clarifier and Oliver filter; replacement of the wooden buildings by a steel housing with asbestos-cement and aluminium roofs; installation of two 300-kW turbo-generators and four completely automatic Babcock 682 h.p. boilers; steel supports for the crystallizer station; and a new vacuum pan. Six new crystallizers with Blanchard coils have been installed and four old units modified; all bagasse conveyors have been changed to steel conveyors. Streets have been paved, an air-conditioned laboratory has been built, and mosaic floors laid. Cane ground has increased from 2015 to 2585 tons per day while normal juice extraction is up to 78·07 from 80·04, total losses are down from 2·93 to 1·52% on cane, including the bagasse loss which is down from 0·86 to 0·61% on cane and production losses down from 2·07 to 0·91% on cane.

* * *

Cleaning of the Hampden Estates' Evaporator. A. C. G. COLE. *Jamaican Assoc. Sugar Tech. J.*, 1957, **20,** 46–50.—As a result of trials over several crops it was found that cleaning with a 50°Bx NaOH solution, followed by 5% "Versene" (EDTA) solution cleaned the tubes satisfactorily. Although this method is more expensive than hand cleaning, the time-saving offsets this. In addition, the spent caustic soda can be used to clean the juice heaters.

* * *

Operation of Frome Bulk Sugar Store—Crops 1956 and 1957. M. B. FLORO. *Jamaican Assoc. Sugar Tech. J.*, 1957, **20,** 53–55.—Observations recorded on keeping quality of sugar stored in 1956 and 1957 at Frome indicate that re-piling greatly diminishes caking and colour formation. The ratio of unfilled volume to filled volume is very important, perhaps more than the time factor.

* * *

The Thompson-Eisner Furnace at Worthy Park. O. M. CLARKE. *Jamaican Assoc. Sugar Tech. J.*, 1957, **20,** 72–73.—Modifications to No. 2 furnace, as mentioned previously[1], have been carried out, with the desired improvement, although there is still a certain amount of carry-over. In addition, beneficial effects in furnace operation and boiler steaming out have been achieved by installing an "Arca" steam pressure regulator in the feed line to the forced-draught turbo-blowers, and adjusting the stop-piece so as to keep the blowers "ticking-over" so that they would start immediately the pressure regulator started opening.

* * *

The Automatic Limer at Duckenfield. E. J. MOL. *Jamaican Assoc. Sugar Tech. J.*, 1957, **20,** 73–79.—The equipment described includes a tank in which juice is underlimed somewhat with 1·5°Bé milk of lime and mixed by a stirrer; it siphons into a second tank and is mixed more thoroughly. A sample is withdrawn continuously, pumped through a glass electrode assembly and returns to the second tank. A pneumatic signal from the electrode controls the valve of a second lime feed into the sample return pipe.

* * *

Instrument Training Programme for Cuban Sugar Mill Technicians. G. E. OCHOA. *Sugar J.* (La.), 1959, **22,** (8), 29–30.—Courses in basic instrument practice and maintenance have been held at intervals since 1951.

[1] *I.S.J.*, 1958, **60,** 365.

Features of Flat and Comb-Shaped Diffusion Knife Systems. P. S. SICHEVOI. *Sakhar. Prom.*, 1958, (10), 10–14.—As previously mentioned[1], comb-shaped knives make longitudinal cuts in the beets, while flat knives, placed across these, cut the strips to the required thickness. The height to which the comb-shaped knives must be set above the edge of the flat knives depends on the horizontal clearance between them, which depends on the cleanliness or otherwise of the beet. Comb-shaped knives with a rectangular trapezium-shaped cutting edge are better than disc-shaped knives, and a multi-position shaft is recommended (the example cited has four positions so that a new row of knives is presented by turning the shaft through 90°). Sharpening of knives and knife setting are also discussed.

* * *

The use of Hydrocyclones in Sugar Production. G. I. ADAMOV. *Sakhar. Prom.*, 1958, (10), 14–20.—In tests of mud removal from first and second carbonatation juices with hydrocyclones, it was found that single-stage treatment of the former with a 84-mm dia. cyclone, at 5–6·5 atm feed pressure, was inadequate although even such separation as was effected would help the clarification station. A multistage system is to be tried out in the near future. For 2nd carbonatation juice a two-stage system is required, with hydro-cyclones of 71 mm dia. and sludge nozzles of 19–14 mm dia. for a throughput of 150–160 metric tons of beet per day. At a juice feed pressure of 5–5·5 atm and a temperature of at least 90°C, at least 90% separation may be effected. Further uses for hydrocyclones include sand separation from milk of lime, for which a feed pressure of 2·5–3 atm and a discharge nozzle dia. of 8–10 mm are suggested, and the purification of flume water for which a 300 mm dia. unit would handle 160 cu.m./hr at a feed pressure of 2–2·5 atm. The necessity of maintaining constant pressure is emphasized.

* * *

Behaviour of Sugars (Raffinose) in the Factory. O. V. BRAUN. *Sakhar. Prom.*, 1958, (10), 26–29.—Investigations of the sugars in beet from two different districts of the Ukraine showed that the raffinose content of beet from the Western Ukraine was greater than that from the Yagotinsk region. The raffinose increases from December onwards in all the factory products, being less in the green syrup than in preceding products. The suggestion that its crystallization with white sugar upsets the factory balance and that it makes processing difficult is not supported by an editorial footnote which points out that no more than 1% of raffinose has ever been found in white sugar.

Return of Clarifier Muds to Predefecation. N. F. DOBRONRAVOV and A. M. GERASIMOVA. *Sakhar. Prom.*, 1958, (10), 21–26.—Laboratory and factory tests were made to determine the effect of the return of clarifier muds to predefecation on diffusion juice purification and the performance of vacuum filters. It was found that the best results, i.e. filtration rate, settling properties of the muds, and quality of the second carbonatation juice, were obtained when the amount of muds returned was equal to the amount of first carbonatation juice, preceded by raising the pH of the diffusion juice to 10, or with two mud additions, with intermediate raising of the pH to this level. Predefecation should be carried out for 3–4 minutes at 85–90°C, cold predefecation not being recommended.

* * *

Overflow Prevention. V. I. CHOPIK. *Sakhar. Prom.*, 1958, (10), 36–38.—Suggested methods of prevention of spillage of various sugar liquors, etc., include the use of compressed air to provide an automatic seal such that when the level of juice in the storage tank after the filters rises to a danger level, an air-lock is formed in the feed line to the filters (this system is also used to prevent wash-water overflow at one factory); valves actuated by electrical contacts at the juice danger level; and overflow return pipes from filter troughs, molasses weighers and juice heaters.

* * *

Rational Construction of Battery Screens. N. F. POKASOVSKII. *Sakhar. Prom.*, 1958, (10), 40–42.—As a result of providing the bottom conical screen of a new battery with longitudinal ridges, the screen cross-sectional area was increased by 30% and certain defects in the diffuser were remedied, especially the break-through of cossettes to the pulp trap, with consequent ill-effects on juice purification.

* * *

DS–800 Automatic Beet Scales. S. M. VYSOTSKII. *Sakhar. Prom.*, 1958, (10), 43–47.—Details are given of an automatic batch weigher for beet which can handle up to 100 tons/hr and which has given satisfactory results over two campaigns at one factory.

* * *

Hydrostatic Method of Determining the Amount of Final Molasses in the Storage Tanks. D. I. KAPELYUSHNYI and P. K. SEMENENKO. *Sakhar. Prom.*, 1958, (10), 48–50.—A pneumatic depth gauge is described and illustrated.

* * *

Apparatus for Automatic Juice Level Control. T. JAWOROWSKI. *Gaz. Cukr.*, 1958, **60**, 308–310.—

[1] *I.S.J.*, 1958, **60**, 173.

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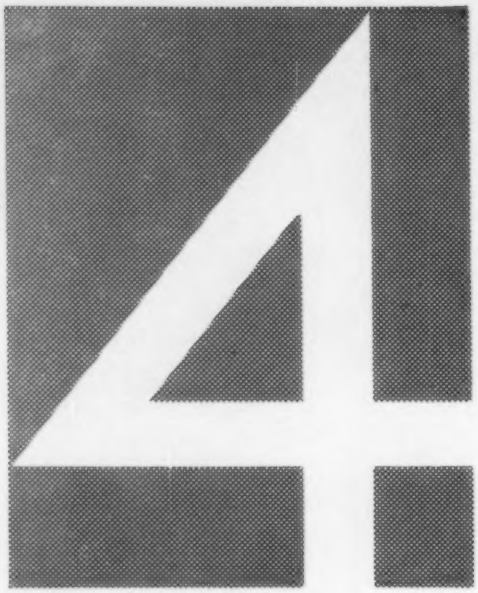

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Details are given of an evaporator juice level control. Rise or fall of fluid in a float chamber corresponds to the change of level in the evaporator and causes the rotation in one or other direction of a cam shaft to which the float is connected by levers. A cam follower is moved, affecting the position of a needle valves so that oil is pumped through one of two nozzles, hydraulically opening or closing the juice feed valve to return the level in the evaporator to its proper height.

* * *

Automatic Control in the Sugar Industry. S. ZAGRODZKI. *Gaz. Cukr.*, 1958, **60,** 301–304.—Automatic control of the various processes in a beet sugar factory is reviewed with 11 references to the literature.

* * *

The Use of "Steelon" in the Sugar Industry[1]**.** W. GÓRALCZYK and B. ZELBA. *Gaz. Cukr.*, 1958, **60,** 304–308.—The use of "Steelon" (Polish "Nylon" polyamide synthetic fibre) filter cloths in beet factories is discussed. Pre-shrinking is considered necessary. The cloths, although more expensive than jute, would obviate the necessity of importing jute from Egypt, India and the U.S.A., and their long life would compensate for the higher initial cost. Illustrations are given of three different forms of "Steelon" cloth.

* * *

Sugar Beet Reloading Equipment in 1957. K. PEISKER. *Zucker*, 1958, **11,** 520–524.—The latest equipment for loading beet from road vehicles to railway trucks is reviewed with illustrations.

* * *

Bacteriological Control in Sugar Factories and Paper Chromatographic Studies of Sucrose Conversion by the Bacterial Strains Found. S. LORENZ. *Zeitsch. Zuckerind.*, 1958, **83,** 490–494, 535–541.—Bacteriological control at the beet end of sugar factories is reviewed with 45 references to the literature. Methods of microbe determination, including E. ANDERSEN's "bacteriological activity" method[2] and bacterial counts, are described. The effect of temperature on bacterial metabolism is discussed. Paper chromatographic studies of sucrose degradation by bacteria were made, and the chromatograms are discussed in detail. Of the spore-forming bacteria obtained from raw juice and laboratory-cultured, 45 strains were sucrose-degrading, while only 19 non-spore-forming bacteria were sucrose-degrading. Among these was identified *Protaminobacter rubrum* which forms a reducing conversion product previously described[3].

* * *

New Methods of Steam Usage in the Beet Sugar Factory. W. VON PROSKOWETZ. *Zeitsch. Zuckerind.*, 1958, **83,** 546–553.—The so-called "Last evaporator" system, previously described[4], is further discussed.

* * *

Conditioning and Ensilage of Sugar and Related Mechanization and Automation. L. PALESTRO. *Ind. Sacc. Ital.*, 1958, **51,** 181–196.—A comparison is made between the various types of sugar silo, and the conditioning and storage of raw and white sugar discussed. Storage of sugar in bulk and in bag are compared, and the conveying and automatic weighing, etc., of bulk sugar examined.

* * *

Relationship between Heat Consumption and Digestion of Beets. K. CÍHAL and L. SCHMIDT. *Listy Cukr.*, 1958, **74,** 247–254.—Studies of the relationship between sucrose extracted, draught and heat consumption are reviewed with 26 references to the literature. Investigations carried out over 5 campaigns at 42 Czechoslovakian factories have shown that mean heat consumption was 2721 Mcal per ton of 100°Brix sugar, at a mean sucrose extraction of 18%. Maximum heat consumption was 4283 Mcal/ton at 15·06% sucrose extraction, and the minimum was 1896 Mcal/ton at 21·03%. From the tabulated figures it is deduced that a 1% rise in sucrose extraction causes a decrease of 145 Mcal/ton in heat consumption. Little difference was found between the theoretical and practical figures.

* * *

Chemical Cleaning of Evaporators. II. Tests on the Effect of Caustic Soda Concentration and Boiling Time on the Conversion of Calcium Oxalate to Calcium Carbonate. A. KELLER and R. KELLER. *Zucker*, 1958, **11,** 542–545.—Tests on the conversion of calcium oxalate to carbonate showed that the amount of oxalate converted per unit volume increased regularly up to 50 g/litre caustic soda concentration, the amount after 60 g/litre remaining constant. With a caustic soda concentration of 30–60 g/litre, the maximum conversion is effected by 5 hours' boiling. If boiling is to be carried out for only 2 hours, a caustic soda concentration of <50 g/litre is recommended as the amount of oxalate converted in relation to the amount of caustic soda used is higher at lower concentrations of NaOH. For thick scale, containing 70% oxalate, 2 boilings-out per mm with 40–60 g/litre NaOH solution are required while for 30–50% oxalate only one boiling-out is required with the same concentration.

* * *

The Performance of the Continuous J-Diffuser[5] **at Petőháza Sugar Factory in the 1957/58 Campaign.** K. HABERÉNYI, M. TEGZE, O. VAJDA and K. VUKOV. *Cukoripar*, 1958, **11,** 109–118; through *S.I.A.*, 1958, **20,** Abs. 762.—The plant is fully described and illustrated. Detailed performance results are tabulated and are compared with those of a Robert diffusion battery. Graphs show slightly better pH values, more uniform temperatures and equal or lower sugar losses (despite the shorter diffusion time). The changes in diffusion constants with temperature and time are shown. Juice purities were the same

[1] See also *I.S.J.*, 1958, **60,** 297.
[2] *I.S.J.*, 1955, **57,** 442.
[3] *I.S.J.*, 1958, **60,** 274.
[4] *I.S.J.*, 1958, **60,** 331.
[5] See also *I.S.J.*, 1958, **60,** 178; *I.S.J.*, 1959, **61,** 30.

when no press-water was returned, but slightly lower on return of the waste water. The results are considered at least equal to those with other types of continuous diffuser. Power requirements are low.

* * *

Experience with the "J-III" Diffuser in the Petőháza Sugar Factory. ANON. *Cukoripar*, 1958, **11**, 118–122; through *S.I.A.*, 1958, **20**, Abs. 763.—Various details of operation of the plant, in comparison with a Robert diffusion battery are discussed. The plant requires skilled staff and certain improvements in temperature control, reduction of draw-off, etc., are still needed. The operation has in general been reliable and satisfactory.

* * *

J-Diffusion and the Waste Water Problem. I. SALÁNKI. *Cukoripar*, 1958, **11**, 122-125; through *S.I.A.*, 1958, **20**, Abs. 764.—Continuous diffusers give lower sugar losses than in a diffusion battery. Comparison of the water balance showed that the Robert diffusion battery required 231% of pressure water, on beets, whilst the J-diffuser required 115%. The possibility of re-using waste water is discussed.

* * *

Experiences with Experimental J-Diffusion (Plant). I. SIPOS and L. FRINDT. *Cukoripar*, 1958, **11**, 128–129; through *S.I.A.*, 1958, **20**, Abs. 765.—The plant, after modifications, has now been used for a whole campaign at Hatvan beet sugar factory. No waters are returned; no corrosion has been observed. Care is needed in the filling and skilled labour is required for supervision. Sugar losses are reported to be lower than in the ordinary diffusion battery.

* * *

Semi-Large Scale Juice Purification Experiments with the Return of Normal and Oversaturated Juice. Z. I. TÓTH and K. MAGYAR. *Cukoripar*, 1958, **11**, 162–166; through *S.I.A.*, 1958, **20**, Abs. 770.—Tests were made with and without return of juice, the return being made with either normal saturated juice or oversaturated juice. Comparisons were made of normal factory operation without juice return, and similar treatment of factory type juice in the pilot plant, results from this latter processing being taken as the basis of comparisons. For the oversaturated juice return, the Wiklund method was applied. The results are tabulated in detail and shown in graphs, figures being given for filtration rates (Silin's method and Dedek's F_k value), sedimentation rates, colour, and lime salts content. The best results, in regard to filtration rate, were given by the return of normal saturated juice, but no significant improvement in colour or lime salts content was then observed. The filter cake was of good consistency and sweetened-off well.

* * *

Drum Filter in Mezőhegyes Sugar Factory. B. VICZIÁN, O. TISZAVÁRY and F. EMODI. *Cukoripar*, 1958, **11**, 171–176; through *S.I.A.*, 1958, **20**, Abs. 773.—A modified oil filter used as a rotary vacuum cell-divided drum filter for 1st saturation juice (after passage through a clarifier) is described with diagrams. Of the 18 compartments in the liquor, six are used for sweetening-off, one is a barrier between pressure and vacuum, and two are blind pockets for the knife scraper. The available filtering area and rates of filtration are discussed, and operational results are reported in detail. Best results were obtained after hot pre-liming and up to 45% juice recirculation to defecation. Sweetening-off was best achieved in 7 to 10 mm layers, leaving only 0·87% of sugar in the muds, this being 0·22% less than in work on filter presses.

* * *

Control of Diffusion Work by the Measurement of the Heat-Sensitivity of the Beet. K. VUKOV. *Cukoripar*, 1958, **11**, 156–162; through *S.I.A.*, 1958, **20**, Abs. 833.—For good diffusion, the cossettes should remain firm when the cells are killed. The effects of heating at different temperatures for varying times have been examined by putting sample discs of beet in water at given temperatures and determining the elasticity of the sample, after treatment, by means of a simple apparatus, which is described. Up to 75°C the elasticity varies inversely with the proportion of cells killed by heating; above 75°C (and up to 90°C) the modulus falls at a faster rate. The killing of cells is slower at 65°C, but after 30 min the result is the same as at 70–75°C after 20 min. The modulus should preferably not be <8 kg/sq.cm, and never $<4{\cdot}5$ kg/sq.cm. The heat sensitivity is defined as the difference in elastic modulus of the beet treated at 70°C for 20 min and at 100°C for 7 min. Frozen beets were also tested; they are very heat-sensitive, and for extraction in a J-diffuser, are best treated for a short time at 72–73°C, followed by main extraction at 68–69°C. With less sensitive beets, mashing at 88°C and extraction at 72–73°C is recommended. A correlation was found between the temperature of killing, x, and the content (mg/100 Brix) of colloids, y, in the diffusion juice, the relation being : $y = 0{\cdot}834\ x - 69{\cdot}6$.

* * *

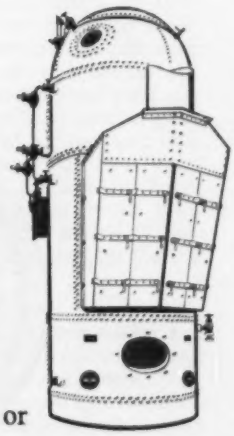
Filter Cloths Made from Artificial Fibres. M. CZIRFUSZ. *Cukoripar*, 1958, **11**, 151–154; through *S.I.A.*, 1958, **20**, Abs. 849.—Nylon, Perlon and polyamide fibre cloths were compared with cotton, hemp and linen cloths for filter-presses or bag filters, e.g. mid-juice of 50°Brix at 90°C and 200 mm pressure. The fibre closeness, strength, elongation or shrinkage and wear of the cloths were measured, as also the purity of the filtrates. The artificial fibre cloths are dearer, but, owing to their much longer life, work out ultimately at a quarter of the cost of the other materials.

* * *

Corrosion of Evaporators by De-Calcified Juice. D. RAMONDT. *Sucr. Belge*, 1958, **78**, 165–166.—The statement by TIBO[1], "that juice decalcified by treatment with ion-exchange resins causes corrosion in

[1] *Sucr. Belge*, 1958, **77**, 416.

steam pressure fluctuations



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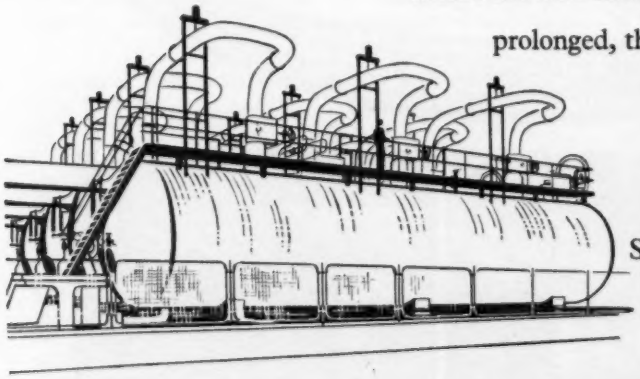

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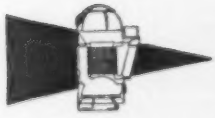

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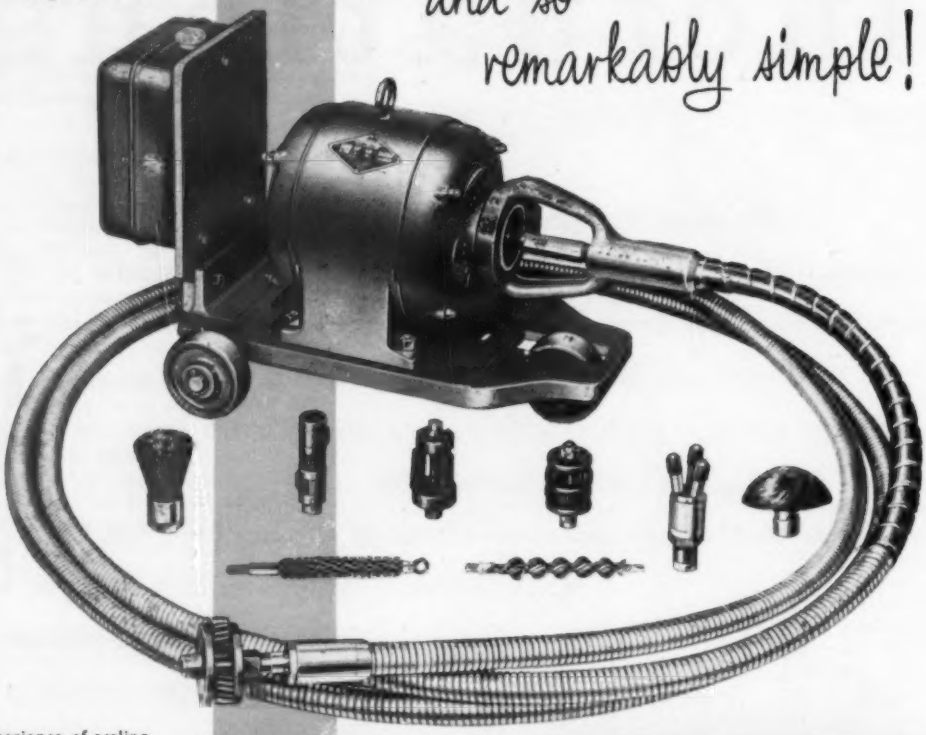

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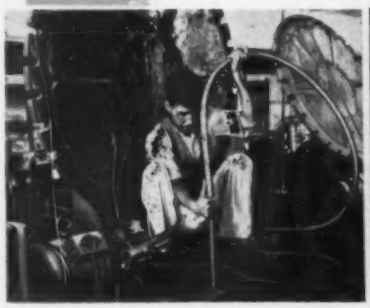

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evaporators" is rebutted as having no theoretical or practical basis.

* * *

Improving Filtration of Beet Sugar Liquor. R. G. FEE. *Sugar y Azúcar*, 1958, **53**, (12), 25–27. —Filter aids are discussed with particular reference to "Fibra-flo 11-C", a mixture of asbestos fibre and diatomaceous earth, which provides rapid pre-coating and easy removal, and "Celkate T–21", a synthetic magnesium silicate, an additive with selective adsorption characteristics, which improves floc removal, foam reduction and colour reduction.

* * *

Sugar Losses in the Diffusion Battery with Accelerated Factory Operation. P. M. SILIN. *Sakhar. Prom.*, 1958, (11), 5–7.—Accelerated beet processing to deal with the increased harvest means reducing battery draught and cutting the cycle time. The effect of this on diffuser performance is discussed, using SILIN's nomogram[1] based on the formula $\gamma = A\theta z$. Calculations are made of losses corresponding to draughts of 125%, 110%, 105% and 100%; cycle times of 67·8 min, 61 min, and 54·2 min ; and beet sucrose content of 15·0%, 17·5% and 20·5% and 20·0%. These calculations are based on a standard loss of 0·4% on beet for a 16-cell battery operating on a 67·8 min cycle, with a draught of 125%, beet sucrose content of 17·5% and a mean temperature of 63°C. Results of the calculations are tabulated and given in the form of nomograms.

* * *

Increasing Diffusion Battery Capacity. S. F. DRONOV. *Sakhar. Prom.*, 1958, (11), 7–10.—A system of maceration-diffusion as tested at Korovinetsk factory[2] is recommended as a means of increasing battery capacity, and advantages of the system are discussed.

* * *

A Study of Percolation of Liquid in a Layer of Heated Beet Cossettes. E. T. KOVAL'. *Sakhar. Prom.*, 1958, (11), 11–15.—In laboratory tests, a cylinder of 145 mm dia. was filled with a known weight of cossettes. At the bottom of the column was a screen of 80% effective area and a bottom flap-valve. The cossettes were heated to 70°C with hot water and water at 70°C (120% on beet) was then introduced through the bottom of the column until the top levels of the cossettes and water were identical. The water was allowed to flow out through the screen, and was weighed and the weight noted continuously on a recorder chart. The rate of flow was calculated from these results, and the hydraulic radius calculated from the porosity of the cossettes and the surface area of cossettes per unit volume. Graphs are drawn, illustrating the effect of various factors, and an equation developed for calculating the hydrostatic pressure h:

$$h = 250 \frac{\tau^{0.45} \times \nu^{0.45}}{l^{0.45} \times 981} v$$

where τ = filtration time in sec, ν = kinematic viscosity in sq.cm./sec, v = mean percolation speed in cm/sec, and l = hydraulic radius of the current in cm. For a constant load l and constant layer structure, $h = av^3$, where a is a constant. From this it is concluded that for values of $\frac{vl}{\nu}$ (Reynolds numbers) from 2 to 30 turbulent percolation will take place. By raising the cossettes on the screen up through the column in counter current to the liquid, the conditions obtaining in a rotary diffuser can be simulated. The above equation for h can then be used to calculate the maximum height of cossette layer and the maximum load per unit area of screen.

* * *

Apparatus for Liquefaction of Foam in Sugar Production. N. A. BURENKOV. *Sakhar. Prom.*, 1958, (11), 16–19.—Two proposals for breaking foam are described. In the first, the foam is fed down a tube into a centrifugal basket, unevenly weighted so as to provide vibratory motion as well as centrifugal force. In the second, a motor-driven vertical-shaft impeller is mounted above the foam layer and below this, in the foam layer, is a diffuser, through which the foam is sucked. The blades of the impeller rotate at great speed (up to 5000 r.p.m.) and break up the foam into droplets which move at great speed and have great kinetic energy, thus themselves helping to break up the layers of foam on the surface of the juice surrounding the diffuser. Vibratory motion is suggested as a means of overcoming friction on the impeller blades.

* * *

Dependence of Sugar Losses on Decomposition and Caramelization on Heating. G. A. KHOMCHUK and L. S. TVERDOKHLEBOV. *Sakhar. Prom.*, 1958, (11), 19–21.—The part played by temperature and retention time in the evaporators is considered in this discussion of sugar decomposition and caramelization. A study of factory data has shown that the reducing substances content of molasses from factories using pressure evaporation was three times greater that that in molasses from factories using vacuum evaporation, and the colour formation was 1·5 times greater. It was also found that with a 60% increase in evaporator heating surface, from 215–240 to 350–375 sq. m./100 tons beet, reducing substances in molasses increased by 600% and colour by 80%. To reduce the losses it is suggested that the retention time be cut, that the specific heating surface be no greater than 240–250 sq.m./100 tons beet, that the maximum steam temperature should be 135°C, that ammoniacal water be fed to the first effect in case of failure of the juice feed, and that all products after thick juice should be kept alkaline, at a pH no lower than 7·0–7·3.

* * *

Electric Drive for the PN–1000 High-Speed Centrifugal. N. R. FREPON. *Sakhar. Prom.*, 1958, (11), 22–25.—Further details are given of the 4-speed high speed PN–1000 centrifugal previously described[3]. After charging at 250 r.p.m., acceleration to 750

[1] See *I.S.J.*, 1958, **60**, 144.
[2] See *I.S.J.*, 1958, **60**, 22.
[3] *I.S.J.*, 1958, **60**, 366.

r.p.m. is started by operation of a switch ; the next speed change is automatic after 40 seconds. After the required time at 1460 r.p.m., the machine is braked electrically down to 100 r.p.m. in time-controlled steps, and then by friction brake to stop, after which the basket rotates in the opposite direction for discharging. Provision is made for manual control and power requirements are 0·7 kWh/100 kg of masse-cuite for a 14-minute cycle and 0·53 kWh/100 kg for a 9-minute cycle.

* * *

Forced Ventilation of Sugar Beet in Piles. V. G. SADKOVSKII. *Sakhar. Prom.*, 1958, (11), 26–30.—The standard forced ventilation scheme which has been adopted in the U.S.S.R. is analysed and compared with those systems used in the U.S.A. and Canada. Transverse ventilation with axial-flow blowers, as used in the U.S.A., is preferred to longitudinal ventilation with centrifugal blowers, since with the latter there is inadequate and uneven distribution of air. This is also true of the standard scheme, where the height of the pile is 3·5 m and the distance between the ducts (7m) is too great. The present duct system is aerodynamically unsuitable and causes constriction with considerable pressure loss. The resultant air velocity is 2·2–3·5m/sec. Assuming 18 million tons of beet to be stacked in 1965, it is proposed that the wooden ducts be replaced by reinforced concrete ducts, that the piles be 7 m high and that more powerful blowers should be used. The question of leaving the piles uncovered is also raised. In an editorial note it is pointed out that the use of reinforced concrete ducts has already been provided for in another scheme.

* * *

The Quality of Brass Tubes for Surface Heat Exchangers. M. S. GABOVICH. *Sakhar. Prom.*, 1958, (11), 33–34.—It is emphasized that whereas brass tubes can be used for heat exchangers in which acid or neutral fluids are heated, steel or stainless steel seamless tubes must be used for alkaline fluids. The most suitable brass of those used in Russian factories is Mark L–70–1, containing 60·5–71% copper, 29–39·5% zinc and 0·4% nickel.

* * *

Regeneration of Lime from Filter Press Muds. M. B. YARMOLINSKII. *Sakhar. Prom.*, 1958, (11), 40–41.—Recovery and regeneration of lime from filter-press muds is recommended as an economical proposition, especially where natural gas is used as a fuel and where the saccharate sugar recovery process is used. Advantage should be taken of the experience gained in the paper industry. At one paper mill, 80% of the lime used (more than 80 tons per day) is recovered from the sludge in rotary kilns of the type used in making cement.

* * *

Prevention of Breakdowns in the Operation of Beet Washers and Pulp Mixers. V. I. MALITSKII. *Sakhar. Prom.*, 1958, (11), 42–43.—Frequent fracture of bearings of a beet washer drive was caused by the high starting torque and by wear of the journals and bushes on the lower shaft due to dirt, causing non-alignment of the shafts and de-centring of the drive. To overcome this the drive was split by installing an extra electric motor, so that the upper shaft could be stopped separately to prevent further flow of beet to the elevator. This halves the starting torque. To prevent dirt penetrating the bearings, these were provided with packing composed of 6 felt washers on each side of the bearings. Iron boxes welded to the bottom of the pulp mixers trap heavy foreign matter, especially pieces of metal. Water is sprayed upwards from a pipe along the bottom of the mixer to prevent clogging of the boxes with pulp.

* * *

The Effect of Micro-Organisms on Technical Processes. Z. ZAREBA. *Gaz. Cukr.*, 1958, **60,** 336–339.—The numbers and types of bacteria found in flume, wash, condenser and diffusion waters, and in diffusion juice are tabulated, with the amounts of sugar decomposed, in mg per 10^9 bacteria. Infection in the beet end is discussed and the amounts of chlorine added at various stages in practice are given as 3–10 mg/litre for flume water, 1–2 mg/litre for wash water; 1–5 mg/litre for recycled condenser water; and 0·6 mg/litre for diffusion water. While the theoretical dosage of formalin in diffusion cells is 0·0025% on juice, in practice 0·005–0·01% is added, usually in the 3rd or 4th cell, the lower amount being effective for 6 hr. The cost of silver salts and quaternary ammonium is too high to allow their use as disinfectants, while SO_2 causes considerable corrosion. Raising the temperature of diffusion to a maximum of 90°C for 5 minutes reduces the bacterial count, while higher temperatures increase the solubilization of pectins. Considerable losses can occur during retention in juice measuring tanks, (0·007–0·01% sugar loss per minute at 40°C at a bacterial count of 10^9/ml). Maintenance of adequate flow rates is recommended.

* * *

Tests on Filter Cloths. S. ZAGRODZKI, Z. NIEDZIELSKI and E. WALERIANCZYK. *Gaz. Cukr.*, 1958, **60,** 342–345.—Experiments were made using "Steelon", linen, rayon, jute and cotton filter cloths. Rate of filtration, filtrate clarity, mud adhesion, and durability were compared, as well as the stretch of the cloths, for which a dynamometer was used. Full details are tabulated and the final order of preference is that given above.

* * *

Practical Supervision of Microbiological Conditions in the Sugar Industry. H. P. HOFFMANN-WALBECK. *Zucker*, 1958, **11,** 565–569.—The necessary steps to counter bacterial infection at the beet end of the sugar factory, i.e. disinfecting and maintaining high temperatures in diffusion and predefecation, are discussed.

* * *

The Olier Continuous Diffuser at Przeworsk. S. ZAGRODZKI, J. DOBRZYCKI and H. ZAORSKA. *Ind. Alim. Agric.*, 1958, **75,** 893–902.—See *I.S.J.*, 1959, **61,** 23.

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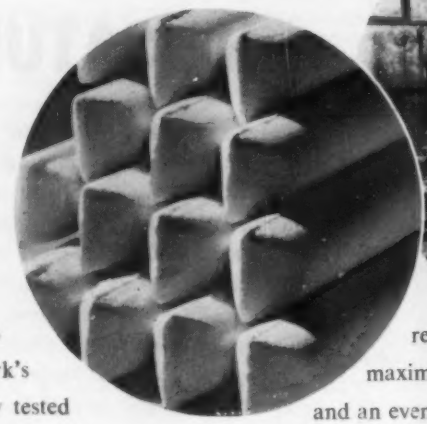

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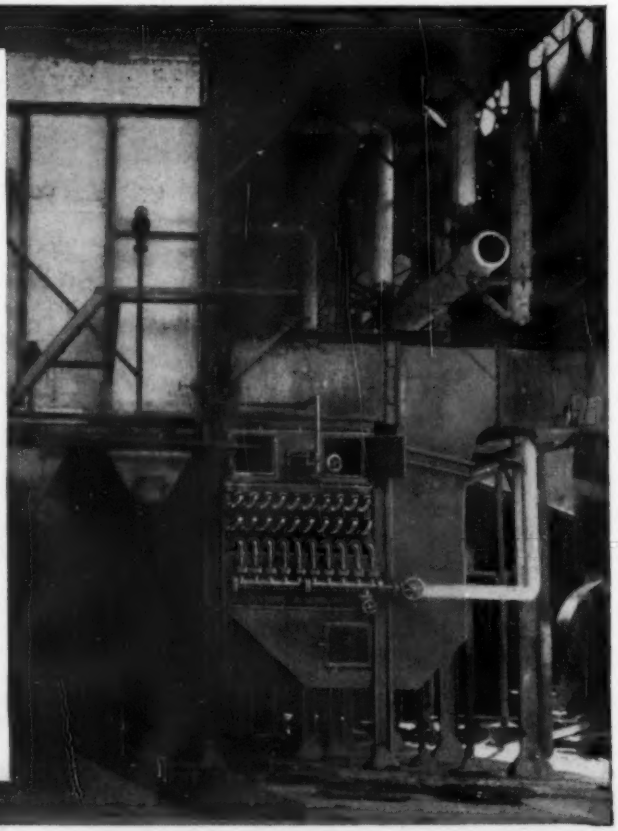

GE 192

NEW BOOKS AND BULLETINS

Analytical Applications of Diamino-Ethane-Tetra-Acetic-Acid. T. S. WEST and A. S. SYKES. 106 pp; 5½×8½ in. (The British Drug Houses Ltd., Laboratory Chemicals Divn., Poole, Dorset.) 1959.

The complexones are discussed generally, and the most familiar, E.D.T.A., referred to in detail, from the aspect of its reactions, in particular as a titrating reagent for metal ions. Aspects of such titrations are considered in chapters on indicators, physical methods of end-point detection, the use of masking and demasking agents, and the literature on determination of metals, anions and water hardness, and analysis of technical material is reviewed, together with analytical applications of other members of the complexone family. The references to the literature total no less than 468, and a useful series of tables give stability constants for ETDA-metal complexes, optimum pH values for complex formations, etc.

* * *

The Australian Sugar Year Book 1959. 584 pp; 7¼×9¾ in. (Strand Press Pty. Ltd., 236 Elizabeth Street, Brisbane, Queensland, Australia.) 1959. Price: 30s. 0d.

Developments in the Australian sugar industry during 1958 are recorded in the latest edition of this comprehensive guide, not only to the industry but also to the towns and districts of the Australian sugar areas. Its format is similar to that of last year, the sugar industry directory, etc., giving up-to-date addresses, personnel and data, although a new item on the bulk sugar handling organizations is an indication of the importance of this modern technique. The Sugar Year Newsreel for 1958 is followed, as previously, by a series of articles, long and short, on aspects of the industry in Australia, the "Twenty facts" article of last year being reprinted. Activities of the Sugar Experiment Stations Advisory Board, C.S.R.Co. Ltd., N.S.W. Cane Growers' Association, Queensland Sugar Board, etc., are reported, and the Sugar Statistics section provides many facts and figures on Queensland sugar including a considerable amount of information on the 1958 season. Once again the largest section of the book refers to the sugar mills and districts, giving details of the area, history, equipment, personnel and directors, and statistics for each mill interspersed with information on the chief towns, beauty spots, etc. of the areas. The new book is attractively printed and bound and will be invaluable to those requiring to make a close survey of the Australian industry.

* * *

Sugar and the European Common Market. P. RUNGE. 8 pp; 6×9½ in. (Instituto Cubano de Estabilización del Azúcar, Havana, Cuba.) 1959.

This pamphlet is a reprint of the author's address to the Sugar Club of New York on February 26th 1959. In it he reviews the concept of the European Common Market and the likely expansion of sugar production by the member countries; he believes that the beet and cane industries could be expanded very considerably to meet their own needs and those of Morocco and Tunisia but that it is not likely that there will be expansion into the external markets; nevertheless, this represents a contraction of 2–300,000 tons in the Free Market.

* * *

Anuario Açucareiro 1953/54/55/56. xiv+112 pp; 8× 11 in. (Instituto do Açúcar e do Alcool, Rio de Janeiro, Brazil.) 1959.

After a brief article on various aspects of the sugar seasons 1951/52 to 1955/56, tables of cane area, production, yields, etc., over the period are tabulated in the "Agricultural Situation" section, while another on the "Industrial Situation" tabulates data on the number of factories, their sugar and alcohol production, etc. The third section, describing the "Commercial Situation", contains statistics on the external market for Brazilian sugar of various types both from the producing areas concerned and the destinations, stocks, consumption, prices and financing. The last section, "General Situation", provides a résumé of some of the information in the previous sections, giving sugar, cane and alcohol production figures for all-Brazil and for the states of the Federation.

* * *

Manual Azucarero Mexicano 1959. Ed. J. G. CARDENAS. 364 pp; 7¾×10¼ in. (Cía. Editora del Manual Azucarero S.A., Balderas No. 44, Desp. 112–113, Mexico 1, D.F.) 1959. Price: 75 pesos ($U.S. 6.00).

The first edition of the Mexican sugar manual, published a year ago, has been extremely successful, it is reported in the prologue to the second and latest edition, and it is finding considerable use in informing not only sugar circles but also those outside the industry of the advances being made in Mexico. These are illustrated by production data and estimates for the period 1951 to 1962, the estimates for the first five years being well exceeded in actual production. The main part of the book follows the same pattern as before, giving up-to-date information of the factories operating during 1958 and their personnel, plant, and agricultural matters, together with production and analytical data in a number of cases. Address and personnel of sugar organizations are given, together with a set of graphs and tables covering gravity factors, steam properties, molasses and syrup viscosities, etc., a directory of factory personnel, and a Buyers' Guide to the products of advertisers in the Manual. The new edition is not printed on such good paper as the first, but is nonetheless useful as a reference work on the sugar industry of Mexico.

LABORATORY METHODS AND CHEMICAL REPORTS

A Table of Coefficients for Obtaining % Sucrose and for Simplifying Calculations in Sucrose Analyses. T. R. ANCHETA. *Sugar News* (Philippines), 1958, **34**, 561–568.—An extensive table of coefficients is provided for calculation of Clerget sucrose, given the direct and invert pol readings. The coefficients have been calculated for 12·0–19·0°Bx and temperatures at invert polarization of 26·0°C to 28·9°C.

* * *

Measurement of Colour and Turbidity in Solutions of White Granulated Sugars. W. O. BERNHARDT, F. G. EIS and R. A. MCGINNIS. *Amer. Chem. Soc.*, 134*th Meeting*, September 1958, *Abstr. of Papers*, p. 19D; through *S.I.A.*, 1958, **20**, Abs. 816.—Colour and turbidity in solutions of white granulated sugars are expressed in terms of attenuancies, A_c^*, measured in a colorimeter having a light source, photoelectric receiver, and optical filters simulating the conditions of observation of the CIE "standard observer" under "source C" illumination. A colourless and turbidity-free 50% solution is used as the reference standard. "Colour" is defined as the component of the solution which attenuates the incident light, but does not produce scattering of the incident beam in excess of the scattering of the reference standard. "Turbidity" is defined as the component of the solution which produces scattering of the incident beam in excess of the scattering of the reference standard. This turbidity may be removed from the solution through a Millipore membrane having a pore size of 0·45μ. Two methods are given for the measurement of colour and turbidity. In the exact method the attenuancies, A_c^*, of the solution are measured before and after mechanical filtration. Colour = A_c^* (filtered) and turbidity = A_c^* (unfiltered) $-A_c^*$ (filtered). In the routine method the mechanical filtration step is eliminated. The attenuancy of the solution due to the turbid materials, $A_{c(T)}^*$, is determined by measurement of angular scattering. The attenuancy due to colouring materials, $A_{c(C)}^*$, is equal to the attenuancy of the unfiltered solution minus $A_{c(T)}^*$.

* * *

Growth of Sucrose Crystals. N. ALBON and W. J. DUNNING. *Amer. Chem. Soc.*, 134*th Meeting*, September 1958, *Abstr. of Papers*, p. 15D; through *S.I.A.*, 1958, **20**, Abs. 827.—Observations of growth hills and etch pits enable the distribution of dislocations to be studied. An elementary growth spiral arising from a single screw dislocation and a double spiral arising from two adjacent dislocations, have been studied. Dislocations are usually of varying strength and interact to produce patterns of steps of varying height. Glucose impurities in sucrose solutions resulted in crystals having dislocations with large Burger's vectors, whereas fructose impurities had no effect on the vectors. The rate of movement of steps is dependent upon the supersaturation and temperature, but is independent of step height. The vertical rate of growth of a step face can be obtained from the rate of movement of the steps and from the separation between the steps. The influence of supersaturation has been determined. (*Cf. I.S.J.*, 1958, **60**, 172).

* * *

Methods for the Determination of Total Amino Acid Content, Particularly in Sugar Beet. K. VUKOV. *Elelmezési Ipar*, 1958, **12**, 198–200; through *S.I.A.*, 1958, **20**, Abs. 826.—The "blue values" obtained by the Stanek-Pavlas rapid method are compared with the true amino acid nitrogen contents, determined by the method of POPE & STEVENS, as modified by SLAVÍCKOVÁ for beets. The results, shown graphically, give a curve $y = 0{\cdot}94\,x + 0{\cdot}9$, where $y = \alpha$-amino-N in mg/100 g, and x = blue number. The error in blue number determination is however greater than expected, so that these values can give only a rough guide.

* * *

Effect of Crystal Size on Impurities in Hawaiian Raw Cane Sugar. K. M. ONNA and C. C. TU. *Amer. Chem. Soc.*, 134*th Meeting*, September 1958, *Abstr. of Papers*, p. 17D; through *S.I.A.*, 1958, **20**, Abs. 832.—The distribution of impurities which affect the refining qualities of Hawaiian raws was studied by sieving the sugar into different size fractions, washing to remove surface contaminants, and examining each fraction for colour, conductimetric ash and amount of precipitate with methanol treatment. Colour decreased with decreasing crystal size, and so did the ash and precipitate except in the finest screen fraction. Saccharides that may affect the crystal habit were found as contaminants.

* * *

Limit of Accuracy in the Analysis of Carbonatation Juice and Final Molasses. S. F. SKORBILIN. *Sakhar. Prom.*, 1958, (11) 49–51.—A two-litre sample of second carbonatation juice was analysed, 10 refractometer readings being made and 10 sugar determinations in the same 100/110 ml flask. The maximum differences between the mean refractometric dry solids was 0·1, which corresponds roughly to a purity error of 1 unit. The maximum deviation from the mean of the purity determinations was about 0·6 (occurring in about 1% of the analyses), and this is taken as the upper limit of purity readings. Molasses was analysed by normal dilution and by 1:1 dilution methods; as the dry solids value was lower and the purity higher with the 1:1 dilution method compared with the normal dilution method, it is recommended that direct refractometric Brix determination and polarization of the normal weight in 100 ml of solution be used for syrups and molasses and 1:1 dilution for massecuites.

Physical Chemistry of Sucrose. IV. Further Double Compounds of Sucrose with Inorganic Salts. G. VAVRINECZ. *Elelmezési Ipar*, 1958, **12**, 114–116; through *S.I.A.*, 1958, **20**, Abs. 837.—Of 24 compounds reported in the literature (which is critically reviewed), only six are considered to have certain existence: $NaCl.sucrose.2H_2O$; $NaBr.sucrose.2H_2O$; $NaI.sucrose.2H_2O$; $3NaI.2\ sucrose.3H_2O$; $KI.sucrose.2H_2O$; $CuSO_4.sucrose.4H_2O$. Present experiments by the author have dealt with only an attempted KBr compound, and the $CuSO_4$ compound. In attempting to crystallize such compounds, exact ratios of sugar and salt should be used, with only slight supersaturation and uniform, but not too high, temperatures. Crystallization may take months or years, so that a constant temperature room is required. The crystals can be washed with increasing concentrations of alcohol (saturated with the ingredients) up to absolute alcohol, and then with benzene.

* * *

Reaction of Sucrose with Glycol-Cleaving Oxidants. A. K. MITRA and A. S. PERLIN. *Amer. Chem. Soc.*, 134*th Meeting*, September 1958, *Abstr. of Papers*, p. 8D; through *S.I.A.*, 1958, **20**, Abs. 838.—In the presence of excess periodate or lead tetra-acetate, sucrose consumes the calculated 3 moles of reagent. It has now been found, however, that these two agents attack sucrose differently. Lead tetra-acetate in acetic acid is reduced at an unusually rapid rate by the sugar because of a vigorous preferential splitting of the 3,4-glycol group. in the D-fructofuranosyl moiety. By contrast, periodate promotes an initial oxidation of the D-glucose unit. These marked specificities are also exhibited in the same solvent ; in 50% acetic acid, the fructose unit of sucrose utilizes 90% of the added lead tetra-acetate (one mole/mole), and the glucose unit utilizes 70% of the added periodate (one mole/mole). The differences appear to be related to the characteristics of the oxidants themselves. This selective oxidation provides a chemical method for controlled degradation of sucrose and gives products in which either the fructose or the glucose residue is modified.

* * *

Methods for Determining the Bacterial Count of (Waste) Waters and Sugar Juices. E. NIEPOKOJCZYCKA. *Gaz. Cukr.*, 1958, **60**, 340–342.—A review is made of techniques used in sterilization, sampling, culture preparation, plating, microscopic examination and staining of bacteria.

* * *

Determination of L-Glutamic Acid in Sugar Factory Products. S. BÖTTGER and W. STEINMETZER. *Zeitsch. Zuckerind.*, 1958, **83**, 583–588.—The more important methods of determining L-glutamic acid are reviewed with 50 references to the literature. An enzymatic method is examined in which the glutamic acid is estimated from the CO_2, determined manometrically with a Warburg apparatus, liberated on the action of decarboxylase enzyme from black winter radish or from bacteria (*Clostridium welchii*). D-Glutamic acid is not affected by either enzyme and other amino-acids do not affect the determination. The optima[1] pH with radish decarboxylase is $5{\cdot}5 \pm 0{\cdot}5$ and with the bacterial enzyme is $4{\cdot}5 \pm 0{\cdot}5$. Both enzymes were still active in molasses and vinasse on completion of the reaction, and added amounts of L-glutamic acid were determined quantitatively. Prior hydrolysis of lactams in molasses or vinasse requires heating several hours at 90–100°C at a pH of less than 2 or higher than 12.

* * *

Ion Exchange Method for Determining Ash in Sugar Products. S. ZAGRODZKI and H. ZAORSKA. *Zeitsch. Zuckerind.*, 1958, **83**, 589–591.—Through a column of "Wofatit KPS 200" cation exchange resin of 20 meq capacity and charged with ammonium ions is passed a test solution of the sugar product, of 10 or less meq ash content (3g molasses or thick juice); this is followed by 20 ml 2*N* ammonium carbonate and 75–80 ml distilled water. To 25–50 ml of this eluate I is added 5 ml *N* NaOH and the solution warmed to drive off ammonia. It is then titrated with 0·2*N* or 0·5*N* HCl using methyl orange indicator and the total K + Na content calculated from the difference between this titre and that for the NaOH added. The $(NH_4)_2CO_3$-treated resin is then eluted with 0·25*N* HCl and washed with distilled water and then with ml 25% ammonia and more distilled water; the combined eluates and washings (eluate II) is made up to 100 ml and used to titrate 5 ml of EDTA solution containing 2 ml ammonia buffer, sodium sulphide if heavy metals are present, and "Eriochrome Black" indicator. Comparison of the amount of eluate II with the amount of standard Ca solution required to give the same colour change gives the (Ca + Mg) content of the original sample. Good correlation has been found between this method and by ashing, using thick juice, molasses and vinasse.

* * *

Nomogram for Determination of °Stammer/Dry Solids and of the Decolorizing Effect. O. SZABOLCS. *Zeitsch. Zuckerind.*, 1958, **83**, 591-592.—A nomogram is given, based on an equation which is derived for conversion of extinction values to °Stammer, where a photometer with an interference filter is used.

* * *

Chemical Control in Sugar Factories—Polarization vs. Sucrose. B. B. GAIROLA. *Indian Sugar*, 1958, **8**, 437–438.—Reasons are put forward for the author's opinion that polarization is a better basis than sucrose analysis for quantities balances in sugar factory accounting.

* * *

Composition of Sugar Factory Waste Water. D. KRAMER. *Zucker*, 1959, **12**, 13–19.—The literature relating to the composition of beet factory waste water is reviewed with 26 references, and analyses, carried out in 1953/54 and 1954/55, are discussed. These show that while the amount of organic matter and residue after evaporation depend on the water requirement of the factory, as do nitrogen, phosphate and potassium contents, while the sodium and sulphate are not affected.

Taiwan S.W.C. vs. Refined Sugar. C. A. LEE. *Taiwan Sugar*, 1958, **5**, (9), 21–23.—S.W.C. (Superior White Crystal) sugar compares very favourably with refined sugar according to the standards of the American Bottlers' Committee. The only major drawback has been a higher ash content and this can be reduced to below 0·02%, if necessary, by adding Na_2CO_3 to 2nd carbonatation juice to remove Ca and/or remelting B-sugar and graining A-massecuites on syrup.

* * *

Comparison of α-Naphthol and Molybdenum Reagents for the Detection of Sugar in Feed Waters. M. FRIML. *Listy Cukr.*, 1958, **74**, 277–278.—The α-naphthol test for traces of sugar in feed water was compared with the ammonium molybdate method[1]. The former was found to be more sensitive, a rose colour appearing at 0·001% sugar, while with the molybdate method, a blue colour appeared only at 0·01% sugar, an increase in molybdate concentration from 5 to 10 g/100 ml having little effect. The blue colour strength depends on the reaction time, requiring 30 seconds at laboratory temperature to reach maximum intensity, thereafter not changing in intensity. The α-naphthol test is preferred in spite of the easy regeneration of the molybdate.

* * *

Automatic Thermostat for Heating and Cooling Digestion Pulp. A. A. GROKHOVSKII and P. I. YAREMENKO. *Sakhar. Prom.*, 1958, (12), 23–30.—An apparatus designed to heat and cool the beet digestion samples is described and illustrated. It consists essentially of a cold bath and an electrically-heated water bath regulated at 78–80°C, in which are immersed 15 sample vessels suspended from a carrier. After 30 minutes the vessels are transferred to the cold bath where the temperature is maintained at 20°C. Over 500 samples a day can be handled by 3 operators.

* * *

Measurement and Evaluation of Crystallization Velocity. H. G. ROUNDS and P. C. KUNKEL. *J. Amer. Soc. Sugar Beet Tech.*, 1958, **10**, 42–47.—A procedure is described whereby true purity of syrup is determined and this and solids concentration adjusted by addition of sucrose and either addition or evaporation of water. Aliquots, seeded with fondant sugar, are kept at 20°C for the required time and mother liquor concentration measured refractometrically, giving the rate of change of concentration per unit time. Measurements decrease during the campaign, while the raffinose content increases correspondingly. The effects of other impurities have also been measured and agree with those reported elsewhere[2], except in the case of betaine.

* * *

Crystal Forms of Sucrose. A. VANHOOK. *Ind. Sacc. Ital.*, 1958, **51**, 227–231.—Inspection of ordinary refined granulated sugar reveals a wide variety of crystal forms with two extreme types referred to as tabular and columnar crystals. The $c : a$ ratios are usually greater and less than 1·3 for the two types, respectively. The habit modifications demand careful consideration in studies of crystallization rate, and a convenient method for single crystal measurements is described whereby Kucharenko's K value [(area)^3/(weight)^2] is compared with the conversion factor $3k/k'$ where k' is the factor relating area to the square of a crystal dimension and k the factor relating the weight to the cube of that dimension. Various calculated and estimated values of these factors are tabulated. The dependence of these shape and conversion factors on habit variations as represented by the $c : a$ ratio is indicated graphically.

* * *

Chromatographic Analysis in the Sugar Industry. E. MARIANI. *Ind. Sacc. Ital.*, 1958, **51**, 232–245.—The development of chromatographic methods, including gas-liquid systems, is reviewed, together with the applications of such techniques to sugar industry problems.

* * *

New Reagent for Detection of Sucrose. J. HADI. *Cukoripar*, 1958, **11**, 225–226, 280a ; through *S.I.A.*, 1958, **20**, Abs. 938.—Camphor in sulphuric acid gives a bright red colour with sucrose. The reaction can be used for quantitative analysis by photometric determination of the colour. A 1% solution of camphor in conc. H_2SO_4 (times of dissolution of the order of 10 min) is pale yellow ; 1 to 1½ ml of solution is added to 1 ml of the water (previously cooled) to be tested. The maximum colour strength develops in 5 min. The test is sensitive to 5 p.p.m. of sucrose and can be used quantitatively up to 1 mg/ml. For many purposes, visual estimation is suitable. The reaction may also be carried out as a ring test. The cost of camphor is one-third that of α-naphthol and less reagent is required. The disadvantage of the pink colour of the α-naphthol solution is obviated with camphor.

* * *

Determination of Small Amounts of Sucrose with the Anthrone Reagent. L. PAUSZ and J. HADI. *Cukoripar*, 1958, **11**, 259–261 ; through *S.I.A.*, 1958, **20**, Abs. 939.—Laboratory tests have been made of the quantitative determination of small amounts of sucrose in condensate water with anthrone for use of the method in an automatic control apparatus. The preparation of the reagent is described ; the colour was measured by means of a Lange-Roth photometer with yellow filter. The time of waiting for maximum development of the colour was tested at 1 minute intervals ; 15 minutes was usual, but shorter times were required for low sugar concentrations. It is essential for the reagent to be prepared freshly each day. The results of factory tests will be reported later.

* * *

Use of Analytical Formulae in the Sugar Laboratory. J. D. MARINELLO. *Mem. XXXI Conf. Asoc. Técn. Azuc. Cuba*, 1957, 143–148.—Reference is made to the principles of volumetric analysis.

[1] See *I.S.J.*, 1954, **56**, 327.
[2] *I.S.J.*, 1957, **59**, 257.

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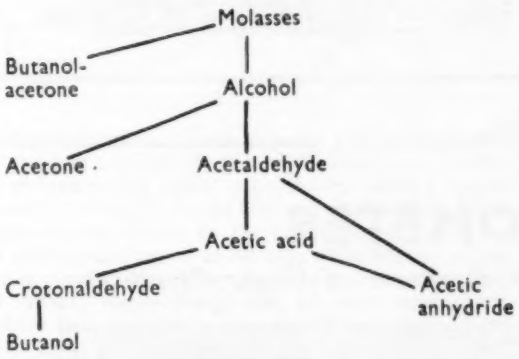

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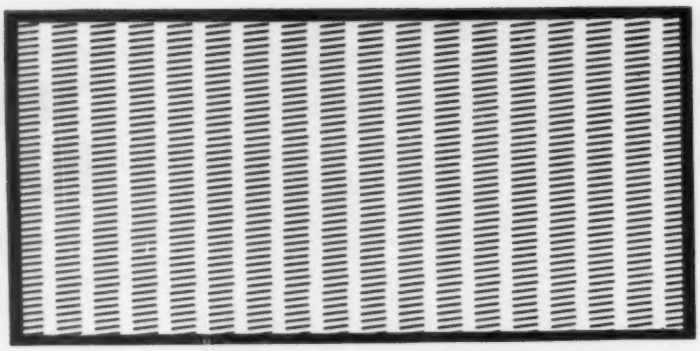

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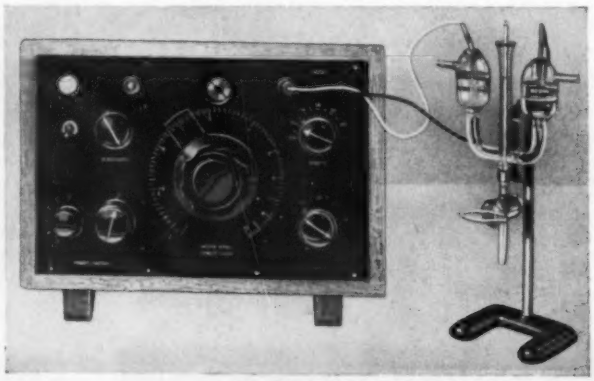

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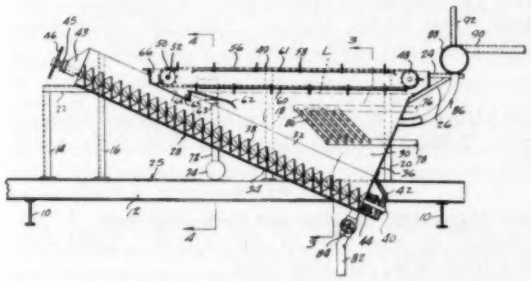
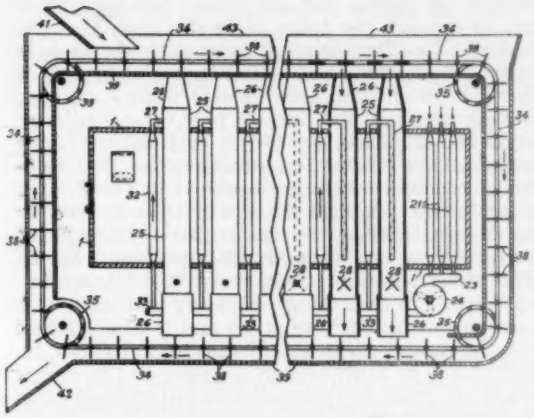
Separating Conditioner (Clarifier). J. A. ACOSTA, of Vero Beach, Fla., U.S.A. **2,843,270.** 11th May 1956; 15th July 1958.—The unit comprises an inclined trough 28 with walls 30 forming a V-shaped cross-section and an end-wall 36. A slurry to be separated into its constituents is introduced through pipe 90 into expansion chamber 88 and may be treated with materials, e.g. with SO_3 or CO_2 introduced through pipe 92. It flows down a bank of curved pipes 86 entering the trough through the end wall 36. The pipes 86 are so shaped that the entering flow is gentle



and gravitational. Steam entering and leaving pipes 80 through conduits 76, 78 heat the slurry to a suitable temperature and solids separate by sinking under gravity or rising to the surface as a scum. The settled solids are withdrawn by the inclined scroll conveyor 38 and are discharged at the top, while floating solids are drawn by slats 58 on the slowly driven conveyor 49 towards the discharge tray 64 which may either deliver floating muds to the edge of the trough where they settle under gravity, or may feed the channel containing the conveyor 38 so that the scum is discharged with the heavier muds. Clear liquor leaves the trough through port 63 which is shielded by apron 62. A port and discharge pipe 82 are provided so that the unit may be emptied and cleaned out.

* * *

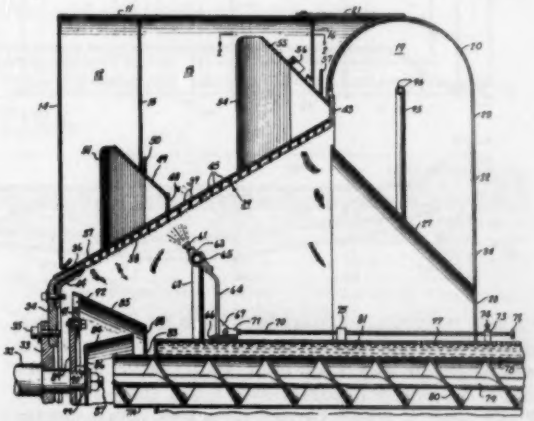
Bagasse Dryer. S. INCLÁN GONZÁLEZ, of Hershey, Cuba. **2,882,612.** 28th August 1956; 21st April 1959.—Bagasse from the mills is delivered through chute 41 and is spread by the endless rake conveyor 38, falling through collector tubes 25. The rate of fall is governed by the speed of the rotatable gates 28. The dried bagasse falls through register boxes 26 and is carried by the conveyor to the discharge chute 42. Gases produced in a furnace are led into the internally insulated steel chamber 1 and surround the collector tubes 25. Ventilator fan 24 draws air through



tubes 21 which pass through chamber 1 (and so causes the air to be heated) and directs it through heater tubes 32 into the perforated tubes 27 where it further dries the bagasse. Partitions in chamber 1 direct the furnace gas path so that all the pipes 25 are heated appropriately, and the effect is to produce a bagasse of 5% moisture or less from mill bagasse containing 60% moisture or more.

* * *

Centrifugal Separator. F. G. SANCHEZ, of Havana, Cuba. **2,883,054.** 4th February 1955; 21st April 1959.—Massecuite or magma is maintained at the required temperature by water jacket 77 and delivered into the centrifugal by means of scroll 80 in feed

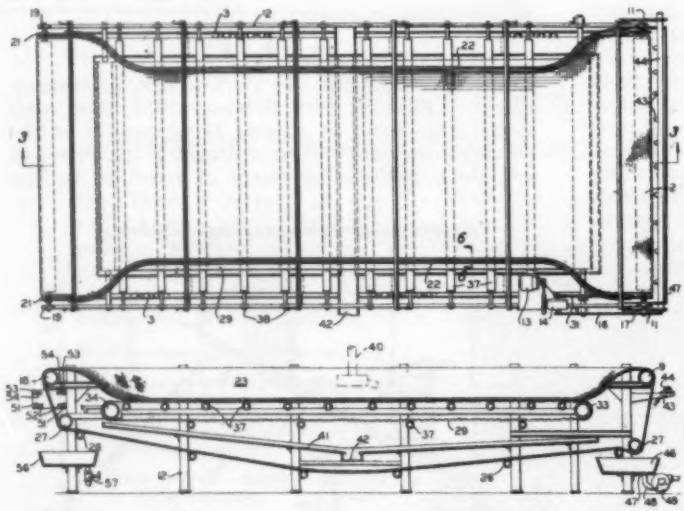


Copies of Specifications of United Kingdom Patents can be obtained on application to H.M. Patent Office, 25 Southampton Buildings, London, W.C.2. (price 3s. 6d. each). United States patent specifications are obtainable from: The Commissioner of Patents, Washington, D.C. (price 25 cents each).

pipe 78. It falls against the inside of cone 84 carried at a high rotatory speed by shaft 32. It is distributed on the inner surface and flows off the edge onto the inside of distributing cone 85. This also rotates with cone 84, a clearance 83 being left in the centre for pipe 78. The massecuite or magma discharges through the openings 92 on to the ring 44 and out on to the screen 38 of purging cone 29. Mother liquor passes through the screen into the spaces between ribs 45 and so through the holes 39 in the cone 37. The passage of mother liquor is assisted by the draught induced by blades 51 mounted on the cone. At a desired location along cone 29 wash water is supplied through nozzle 61 fed through pipe 62 and adjusted by the rod 72. Partitions 15 and 16 divide the casing into chambers, mother liquor being collected in chamber 12 and wash water in chamber 13. The passage of wash water through the screen 38 is assisted by the draught induced by blades 54. Creepage of mother liquor into chamber 13 is prevented by the effect of fan blades 51 and by flange 50, while secondary blades 56 and flange 57 carry out the same function for the wash water, so that it does not mix with the purged sugar which collects in chamber 19. Here it may be dried, melted or re-mingled by means of hot air, water or molasses delivered through holes 96 in the pipe 95.

* * *

Filtration Apparatus and Method. P. W. ALSTON, of Berkeley, Calif., U.S.A. **2,880,875.** 12th December 1955; 7th April 1959.—The filter, to be used for slurries of easily compressible solids, such as the impurities precipitated from beet juice by milk-of-lime, uses as filter medium a continuous belt of fabric 2, both edges of which are attached to swivel conveyor chains 3. The belt passes over a tail shaft 18 and a driven shaft 9 which carries sprockets which engage with the chains 3. The chains follow along guide tracks 22 in the upper part of the loop; these come towards the centre just ahead of the tail shaft and remain parallel until just before reaching the drive shaft, when they again separate to the full width. The effect is to allow the filter cloth to sag in the middle, so forming a shallow basin. This is supported on the open mesh belt 29 which is carried on shafts 33 and 34 and idlers 37 and is driven at the same speed as the belt 2. Liquid is supplied into the basin through weir pan 40 and the filtrate passes through the filter belt 2 and support belt 29 into the collecting tray 41, while the precipitate is carried with the belt over shaft 9 and shaft 27 to discharge into trough 46 partly under gravity and partly by the action of the water from sprays 43. The belt is cleaned at intervals by spray washing, e.g. with 1% HCl, supplied by nozzles 52. The acid is washed off the belt by water sprays 54 and the combined washes are collected by tray 56.



* * *

Citric Acid Production. P. VERGNAUD and R. NIQUET, assrs. LES USINES DE MELLE, S.A., of Saint-Leger-les-Melle, Deux Sèvres, France. **2,883,329.** 27th June 1956; 21st April 1959. See U.K.P. 797,390[1].

* * *

Beet Lifter. D. R. MANSHOLT, of Slootdorp, Netherlands. **2,884,079.** 28th December 1954; 28th April 1959.

* * *

Beet (Harvester) Impeller and Deflecting Unit. L. W. SCHMIDT, of Rio Vista, Calif., U.S.A. **2,884,975.** 23rd June 1958; 5th May 1959.

* * *

Horizontal Leaf Filter. J. W. STAFFORD, assr. FAS-FLO FILTER CORP., of New York, N.Y., U.S.A. **2,885,082.** 31st August 1954; 5th May 1959. See U.K.P. 811,998[2].

* * *

Continuous (Beet) Diffuser. H. A. BRÜNICHE-OLSEN, assr. A.B. DE DANSKE SUKKERFABRIKKER, of Copenhagen, Denmark, and J. C. WRIGHT, F. B. PRICE, C. R. STEELE and H. F. SILVER, assrs. SILVER ENGINEERING WORKS INC., of Denver, Colo., U.S.A. **2,885,311.** 9th January 1957; 5th May 1959.—The unit is of the double-scroll type as covered by U.S.P. 2,713,009 and U.K.P. 743,122[3], and further described earlier[4]; it is provided, however, with intermeshing helical flight sections instead of flat spirals or spokes. The sections are interrupted by breaker bars to give uniform cross-section of cossettes within the conveyor passages, and are constructed of perforated plate members held by radial bars.

[1] *I.S.J.*, 1958, **60**, 277.
[2] *I.S.J.*, 1959, **61**, 220.
[3] *I.S.J.*, 1956, **58**, 345.
[4] *I.S.J.*, 1954, **56**, 277–279.

SUGAR RESEARCH FOUNDATION PLANS FOR 1959/60.

THE Sugar Research Foundation will spend more than a quarter of a million dollars on research in the United States and other countries during the fiscal year which began July 1, according to Dr. H. B. HASS, President of the Foundation.

The projects, covering a wide range of subjects, will concentrate on food technology and non-food uses for sugar. Two research projects are scheduled in the public health field, and the Foundation will again make a grant to the Department of Nutrition of Harvard's School of Public Health. Approximately one-third of this year's Research budget will be spent on food technology, considerably more than in the past. Work which already has attracted wide attention will continue at the University of California on sugar's influence on the consumer acceptance of canned fruits, particularly peaches and pears. A new project on sugar's role in confectionery is scheduled at the Massachusetts Institute of Technology and another new study of sugar in chocolate ice cream will be undertaken at the University of Georgia. A third new project on sugar's use in applesauce and other apple products will begin at the Geneva Experiment Station of Cornell University.

A continuing project on frozen desserts at the University of California in Davis will concentrate on fruit sherbets, while a study of sugar's effect on canned corn and peas begun last year at the University of Wisconsin will enter its second year. A project exploring sugar's effect on fugacity, or the releasing of aroma vapours, continues at the University of London.

Studies on new non-food uses for sugar also will account for some one-third of the budget. Most of these are being carried out in England, Canada and Cuba, and are continuing studies begun in previous years.

Basic research, reflecting the sugar industry's desire to contribute to the generation of new fundamental scientific knowledge, will continue on sugar esters at the University of Ottawa in Ontario, Canada, while at Queens University in Kingston, Ontario, work on derivatives of sugar suitable for ionic replacement reactions will be carried on for another year.

In England, three projects are under way at Royal Holloway College, Surrey: one on aldehyde derivatives; and two on the conversion of mannitol into chelaters and polymerizable products. Carbonate polymers are being studied at the University of Bristol. Hydrogen sulphide derivatives are the subject of a project at the University of London, and non-ester surface-active agents at the University of Birmingham.

In applied research in the non-food field, three projects will be continued. These include one on drying oil esters at Case Institute of Technology in Cleveland, and one on textile assistants at the British Cotton Industry Research Institute, Manchester. The Herstein Laboratories in New York City will continue process studies on amines from sugar, and will function as a screening laboratory for exploration of new research topics.

In the public health field, two studies in protective tooth coatings are scheduled at Polytechnic Institute, Brooklyn and Westwood Research Laboratories, Westwood, Massachusetts.

The Sugar Research Foundation, a non-profit membership corporation, is supported by the cane and beet sugar industry in the United States, and by sugar companies in Australia, Brazil, Canada, Cuba, Dominican Republic, France, Great Britain, India, Peru and the Union of South Africa.

BREVITIES

Czechoslovakian Sugar Factories.[1]—A new 800-ton cane sugar factory has been supplied by Czechoslovakia and has recently finished its first season in Assam, India. In addition, a 2000-ton mill has recently been completed in Canton, Mainland China.

* * *

Bolivian Sugar Plans.[2]—The Bolivian Government plans the erection of two new sugar factories in order to be able to cover the domestic requirements of the country in a reasonable time. At present there are only one large state and three smaller private sugar factories working in Bolivia.

* * *

Booker Bros. McConnell & Co. Ltd. 1958 Report.—Sugar production in 1958 was 252,357 tons on the estates for which Bookers are responsible, nearly 16,000 tons higher than the 1957 record. Sugar profits were significantly down, however, because of the drop in world prices, at which 40% of British Guiana's sugar is sold. Work has started on the construction of the 40,000-ton bulk sugar store and terminal at Ruimveldt[3].

* * *

Tucumán Experiment Station.—The Tucumán Government has published a decree appointing Dr. W. E. CROSS, Director of the Station from 1916 to 1946, to study the present condition of the Tucumán Experiment Station and to draw up a plan of re-organization to bring it to its former efficient and useful state.

[1] *Czech. Heavy Industry*, 1959, (7), 37.
[2] F. O. LICHT, *International Sugar Report*, 1959, **91**, (Supp.11), 156.
[3] *I.S.J.*, 1958, **60**, 249.

BREVITIES

Indian Export Sugar Reduced.[1]—It is reported that India has reduced the tonnage of sugar to be made available for export during the current season ending 31st October 1959 from 100,000 to 25,000 tons. This has been found necessary owing to the lower production of factory sugar and the consequent acute shortage in the home markets. It is stated by the Press that 50,000 tons of the original 100,000 tons are now to be diverted to the domestic market following a review of the situation by the Government.

* * *

Israel Sugar Production 1959[2].–From an outturn of sugar beet of some 135,000 tons, sugar production this year is expected to be in the region of 18,000 tons, according to a Press report, quoting the Israeli Ministry of Agriculture. Last year 12,500 tons of sugar were produced from 100,000 tons of beets. It is stated that the higher tonnage of beets is due to favourable weather conditions, which were also responsible for higher purities. It is anticipated that the two existing factories, both of which are in the north of the country, will reach maximum capacity this season. The building of a factory in the south, with an annual sugar output of 16,000 tons, is planned. It is understood that a French firm will be responsible for the supply of the necessary machinery and equipment up to a value of two million dollars. Additional supplies, estimated to cost $1·5m, will be met mainly from within Israel.

Stock Exchange Quotations

London Stocks (*at* 17*th July*, 1959)

	CLOSING MIDDLE
Anglo-Ceylon (5s)	16/6
Antigua Sugar Factory (£1)	16/–
Booker Bros. (10s)	22/6
British Sugar Corp. Ltd. (£1)	19/6
Caroni Ord. (2s)	4/–
Caroni 6% Cum. Pref. (£1)	17/9
Distillers Co. Ltd. (6s. 8d units)	27/1½
Gledhow Chaka's Kraal (£1)	73/–
Hulett & Sons (£1)	87/6
Jamaica Sugar Estates Ltd. (5s units)	6/9
Leach's Argentine (10s units)	13/3
Reynolds Bros. (£1)	60/9
St. Kitts (London) Ltd. (£1)	60/–
Ste. Madeleine (Ord.) (£1)	31/3
Sena Sugar Estates (10s)	23/–
Tate & Lyle (£1)	45/6
Tate & Lyle Investments Ltd. (5s)	15/–
Trinidad Sugar (5s stock units)	30/9
United Molasses (10s stock units)	34/6
West Indies Sugar Co. Ltd. (£1)	22/6

New York Stocks (*at* 16*th July* 1959)

	CLOSING MIDDLE $
American Crystal ($10)	39
Amer. Sugar Ref. Co. ($100)	31⅝
Central Aguirre ($5)	23
Cuban American ($10)	20½
Great Western Sugar	26⅝
South P.R. Sugar	22¼
United Fruit Co.	35⅜
West Indies Sugar Corp. ($1)	38

Brazil Sugar Exports, 1956-1958[3]

Destination	1958	1957	1956
	(Metric tons, tel quel)*		
AMERICAS:			
Argentina	15,074	—	—
Bolivia	1,070	426	258
Chile	55,648	20,225	—
Uruguay	56,140	30,148	14,544
Total Americas	127,932	50,799	14,802
EUROPE:			
Finland	10,552	17,294	—
France	70,282	9,002	—
Iceland	—	2,044	—
Italy	68,007	—	—
Netherlands	35,895	12,763	—
Portugal	16,336	15,997	—
Spain	10,210	27,837	—
Sweden	8,577	—	—
United Kingdom	54,216	139,788	4,429
Total Europe	274,075	224,725	4,429
AFRICA:			
Egypt	10,426	55,412	—
Morocco	39,865	19,499	—
Sudan	27,072	—	—
Total Africa	77,363	74,911	—
ASIA:			
Ceylon	74,864	12,340	4,150
China (Mainland)	99,431	—	—
Iraq	—	3,370	—
Israel	31,595	15,332	—
Japan	89,528	10,630	—
Malaya	1,021	—	—
Pakistan	—	16,847	—
Total Asia	296,439	58,519	4,150
Grand Total	775,809	408,954	23,381

* Consists of high polarizing "crystal" sugars, refined and Demerara type sugars.

Guatemala's Increasing Sugar Surplus[4].–This year's Guatemalan sugar surplus over domestic requirements and normal stocks is placed at 10,000 short tons, more than has been exported annually in previous years. The minimum annual carryover deemed necessary for domestic needs is 4600 metric tons (5000 short tons). This year's carryover is 15,000 short tons, leaving 10,000 tons available for export. Larger sugar cane crops are likely during the next few years, and as more sugar for export becomes available, Guatemala's interest in world markets can be expected to increase.

* * *

Refining at Umfolozi.[5]—The refinery of Umfolozi Co-operative Sugar Planters Ltd. in Natal was opened officially at the beginning of June. It is planned to refine the total white sugar quota of about 55,000 tons on the crop expectation. The equipment includes a continuous melter and the melt undergoes continuous sulphitation. Sparkler filters are employed, and also a Krauss-Maffei rotary vacuum filter for sweetening-off. The whole melting and clarification plant operates automatically, flow rates, temperatures, densities and pH being controlled by Bristol instruments.

[1] C. Czarnikow Ltd., *Sugar Review*, 1959, (407), 91.
[2] C. Czarnikow Ltd., *Sugar Review*, 1959, (405), 85.
[3] *Lamborn*, 1959, **37**, 137.
[4] *Foreign Crops & Markets*, 30th March, 1959, p. 13.
[5] *S. African Sugar J.*, 1959, **43**, 503–509.

Photo showing a portion of the G-8 48" automatic white and intermediate sugar centrifugals at Spreckels Sugar Company, Spreckels, California.

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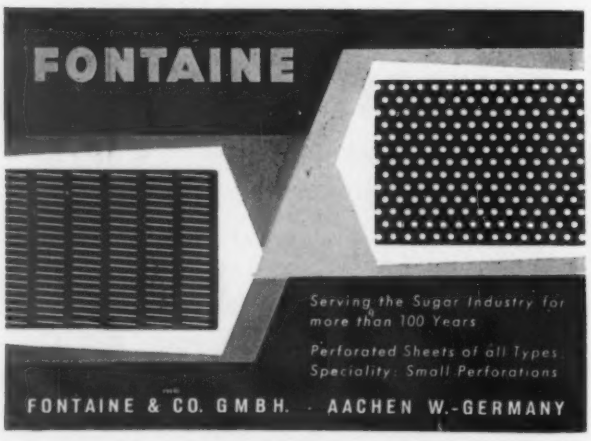
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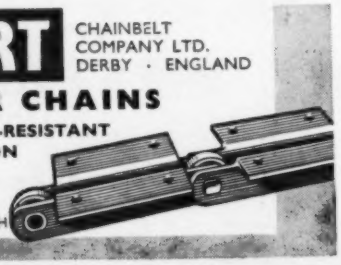

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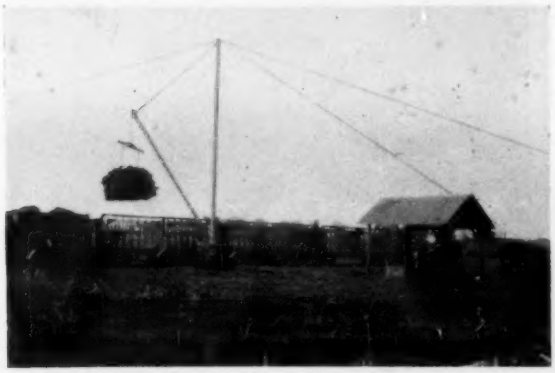

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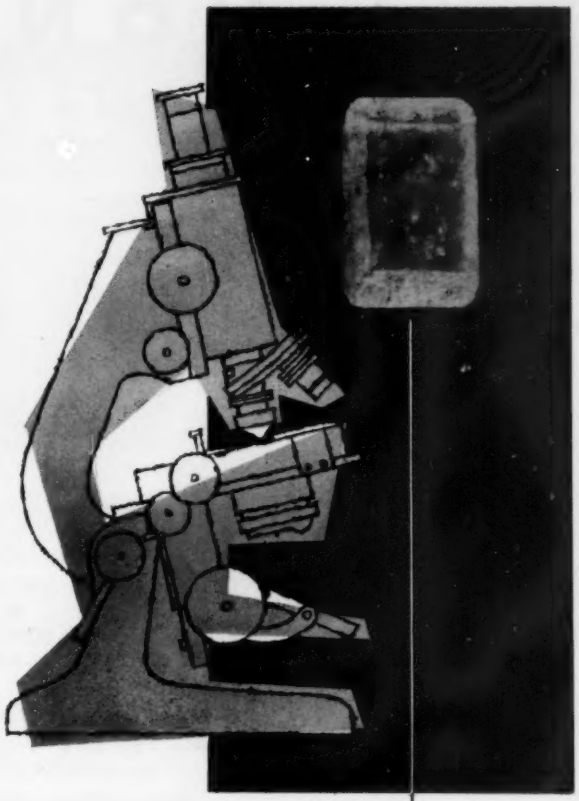

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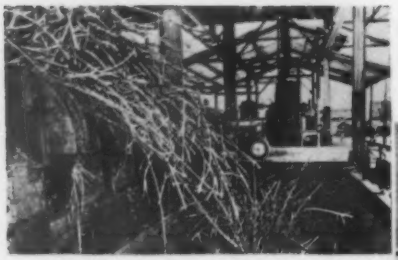

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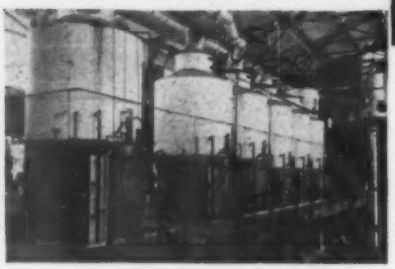

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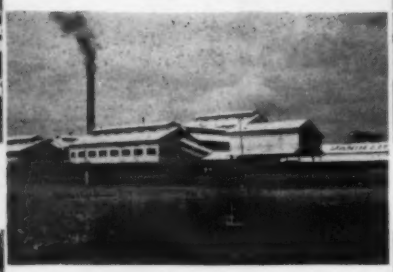

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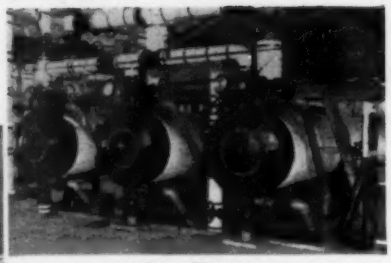

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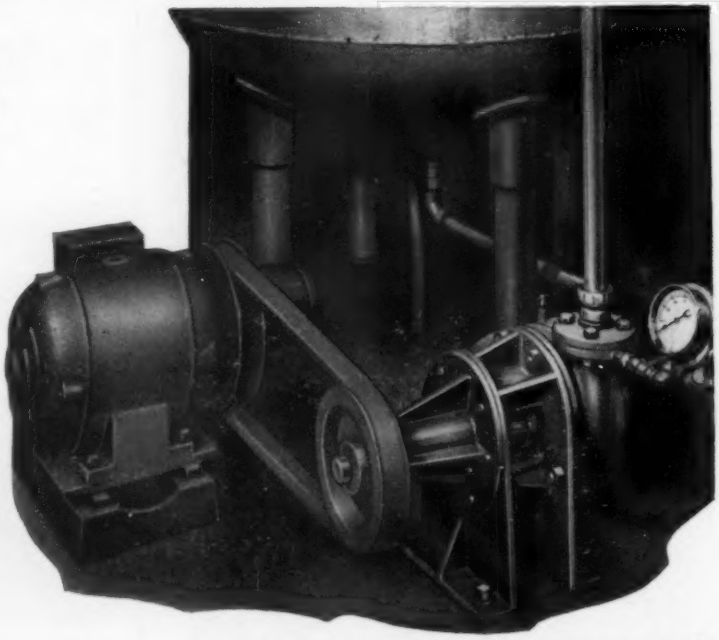

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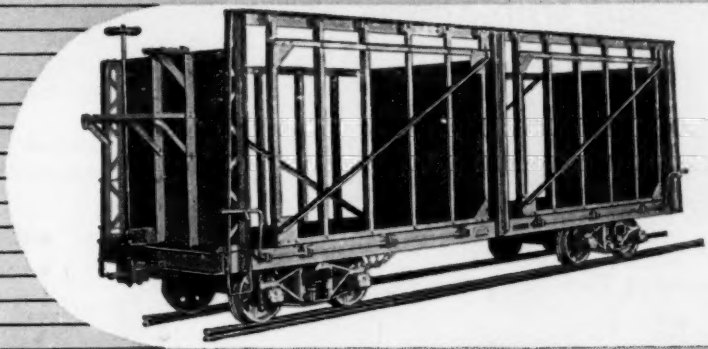

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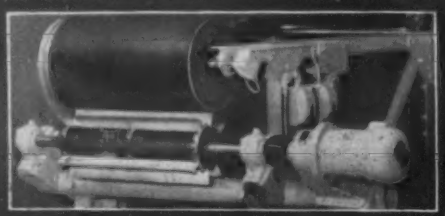

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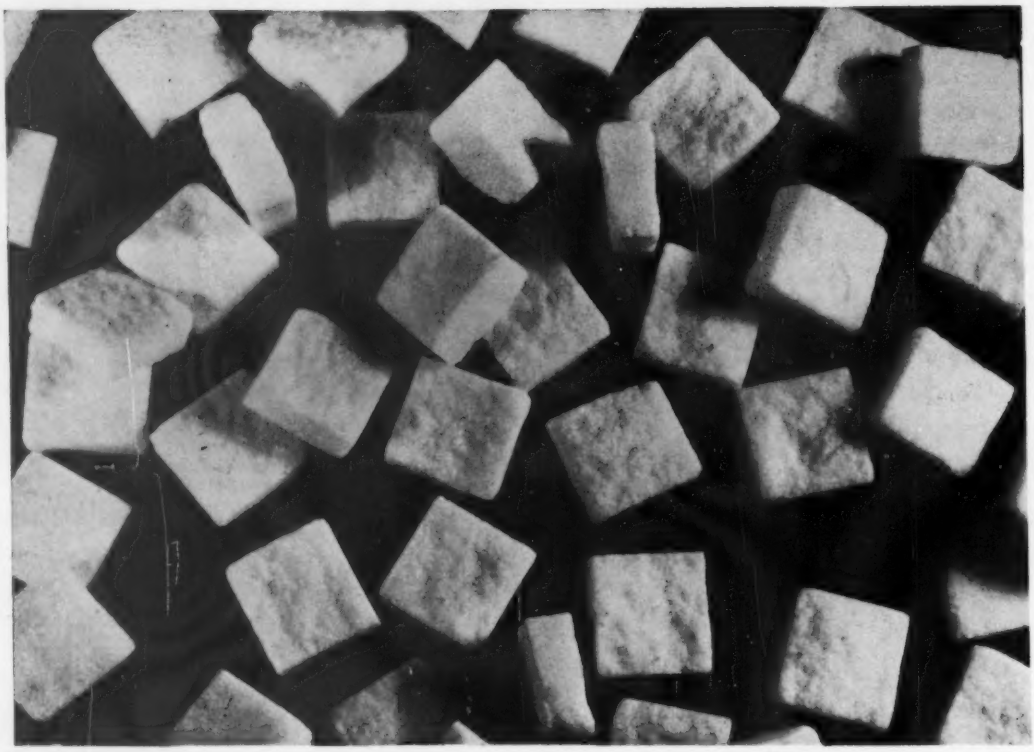

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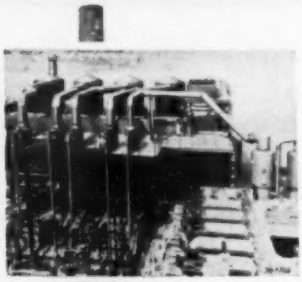

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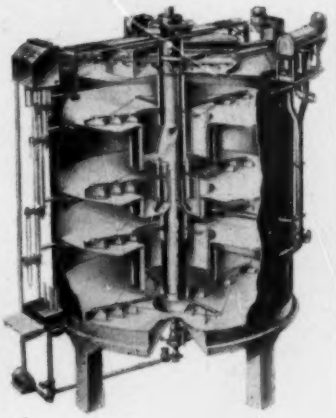

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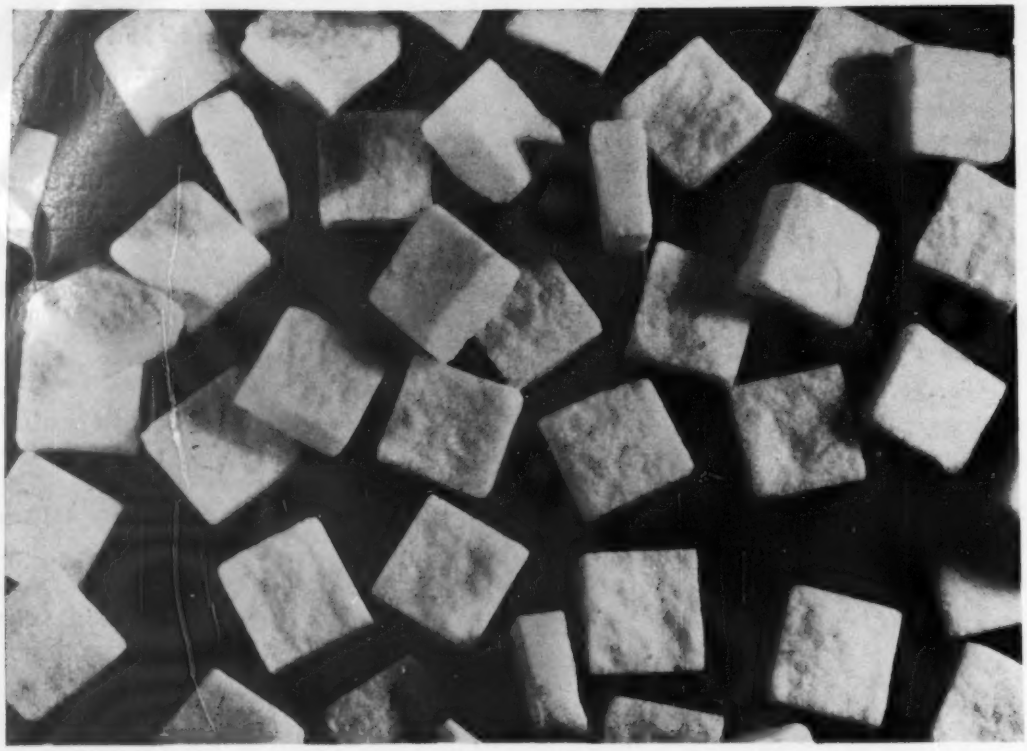

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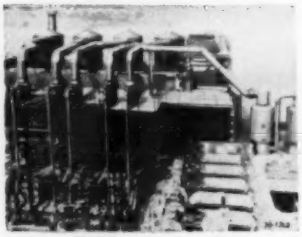

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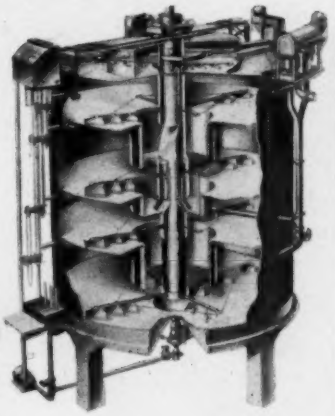

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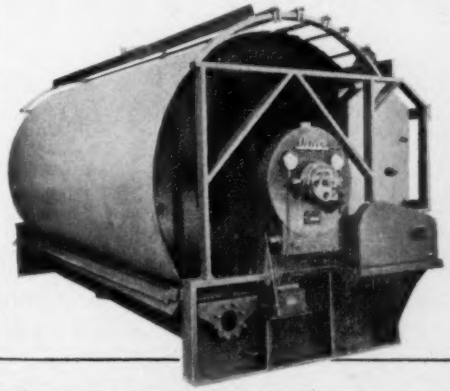

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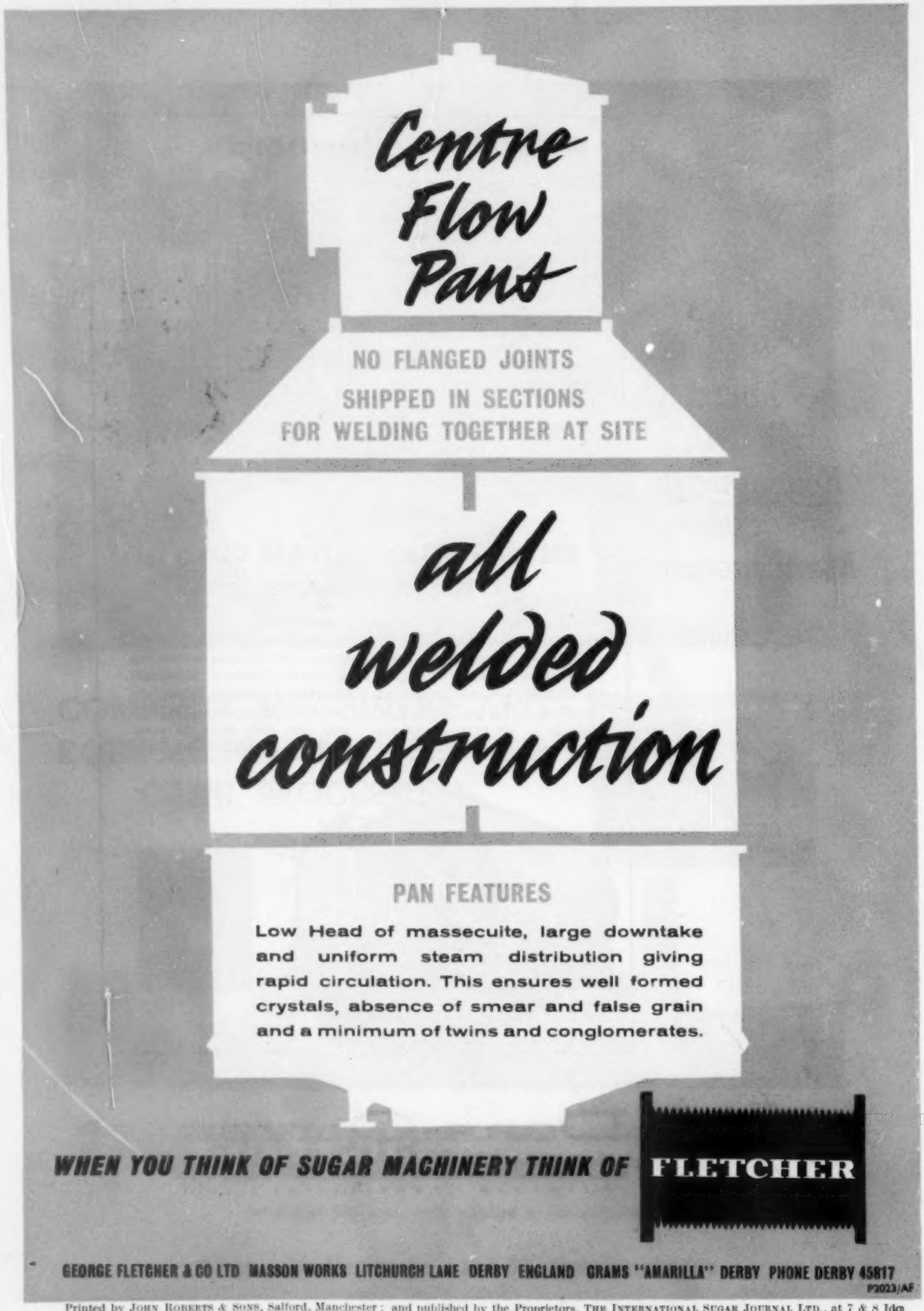
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